January 1984

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sinclair user

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Issue No 22

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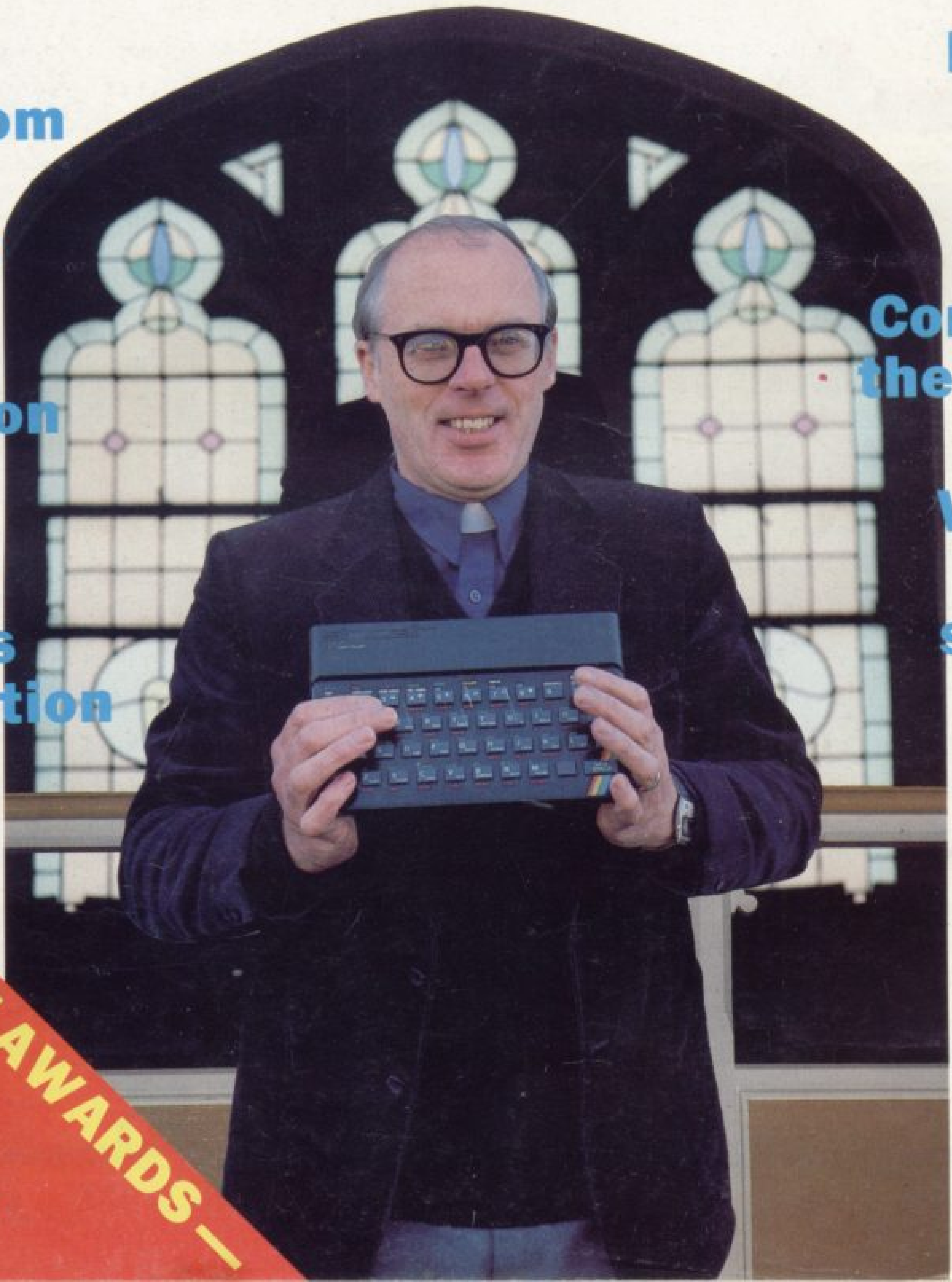
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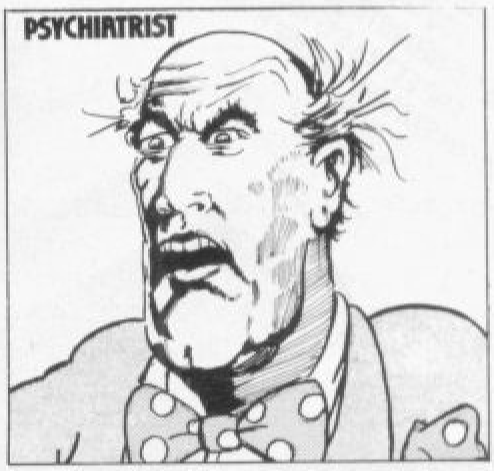
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If you would like to contribute to any of the Sinclair User group of publications please send programs, articles or ideas for hardware projects to:
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NEXT MONTH

John Gilbert reviews the latest programming packs. We also bring you pictures of the Cambridge Award ceremony, plus the usual news, reviews and program listings.



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A more competitive market

THE NEW YEAR is traditionally a time for looking backwards and forwards. An old year has just been completed and has to be raked over before it can be laid to rest. The new year is ready and waiting to be embarked on with all the excitement and trepidation the unknown brings.

Last year was a quiet one for Sinclair users. There was no new computer — just time for the Spectrum to enhance its position as the most popular microcomputer in Britain. Despite its having many critics, particularly for its poor sound and alleged lack of durability, it topped the sales charts consistently, with the other machines struggling to keep pace. It seems likely that there is plenty of life left in the Spectrum. New launches threaten to put a dent in the continued success of the machine but none, not even the Dragon or the Oric, which looked as if they could approach it most closely, has lived up to sales expectations. The Elan appears to have what it takes but, as with the rest, we shall have to wait and see how quickly there can be machines on sale in sufficient numbers to have any real impact.

The major hardware news of the year was, of course, the launch of the Microdrive. After having to wait so long since the first announcement it was almost bound not to live up to all its expectations. Given the length of time people had to build their hopes of what the mass storage device would be able to do, it could safely be predicted that the eventual product would not please everyone. Despite that, it is still a worthwhile enhancement for the Spectrum, when people cease to compare it to disc drive systems and regard it more as a fairly inexpensive way of increasing memory and making loading programs vastly quicker and more simple.

The most important developments last year, however, were not about new releases but about changes in the market. The possibility of being able to make big profits has attracted the bigger companies such as Virgin and Thorn-EMI, with a consequent increase in market sophistication.

Some existing software houses, like Quicksilva and Carnell, had begun to stage software launches and presentations. Virgin, however, hit the market with the full razzmataz of the record industry when it set up Virgin Games. A night club was hired with pop music blaring out and a Mrs Thatcher imitator to attract the Press. The games and their young programmers seemed almost incidental.

Some of the early amateurish romance has left the market but that was essential if sales are to develop away from the enthusiasts. Home computers, despite the increasing amount of coverage in the newspapers and magazines and on television, are still only in about 10 percent of homes in Britain and that is the biggest national percentage in the world.

Those moves have been emphasised by the disappearance of a number of the smaller companies. They have either ceased trading, like Kayde, or have been taken over, like Abersoft being bought by Melbourne House.

The pattern which seems as if it is being followed is that of the book publishing industry, with software houses being purely publishers which contract a number of software writers with the duplication and distribution being another two separate functions.

Looking ahead, much of what can be expected will be the result of what began to happen in 1983. Once the festive boom has departed it can be expected that there will be a further rationalisation of the companies selling Sinclair software and hardware. It is likely that there will be a polarisation into large and very small companies.

There will always be a place for the programmer or hardware enthusiast who sees a gap in the market for a specialised use to which Sinclair machines can be put. That has already occured with programs like Beamscan for use by architects and there are other items in varying stages of development. Those people who wish to make variations of games already being sold should probably do their selling through an established publisher which has the expertise.

Anyone wanting to enter the market hoping to become a major force must think relatively big in product range and launch plans so that a presence can be established quickly.

This year is one which is being seen as the time when some of the smaller computer companies will cease trading. Jupiter Cantab, maker of the Jupiter Ace, has already ceased trading and many people expect some others to go the same way. No doubt there will be others who will introduce new machines to take advantage of that elusive extra 90 percent of British homes, not to mention the export potential. This could be the year when the Japanese finally get it right.

The major news from Sinclair will be its move into the business market. On the same lines as the Microdrive, the appearance of the 'ZX-83' has been talked about a great deal. Sir Clive has said what he considers to be its main elements — a portable with flat-screen television and Microdrive storage



— while others have added the gloss of suggested mock-ups and illustrations. The official word is that it can be expected in the first half of 1984.

It is to be hoped that Sinclair Research gets its marketing correct. Business users are far more demanding and the market is far more competitive. The machines need to be reliable and available, or customers will go elsewhere. Many users have some experience of computers and know what they want. They will not be willing to suffer delays and problems in the same way home owners have done.

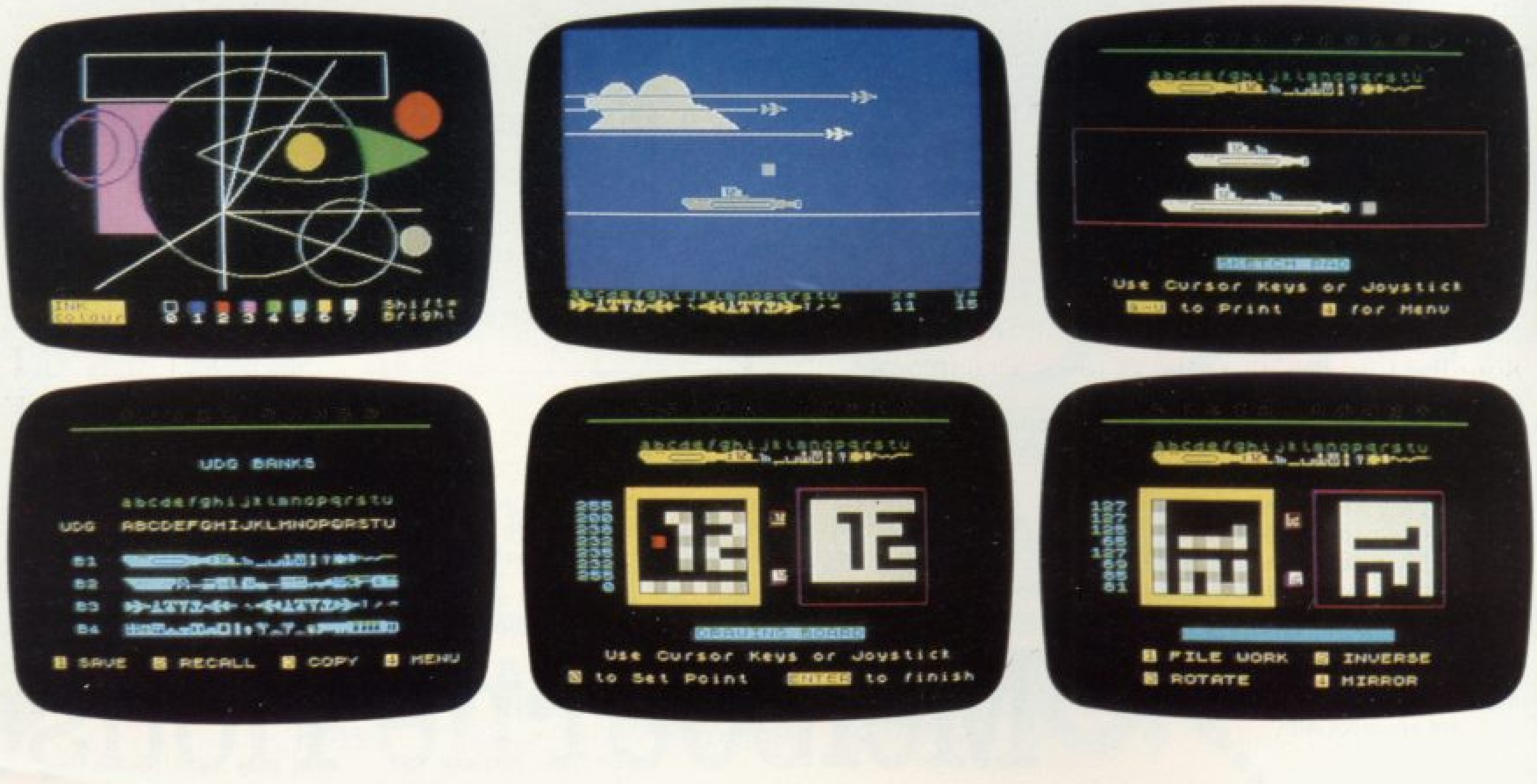
Sinclair presumably will sell on price, banking on high volume to compensate for narrower margins. It will have to offer much more back-up than it does at present. Other areas of the business market have realised that and are willing to provide what the market demands. After paying for software, peripherals and training, the price of the basic machine is often the least important consideration in buying a new system. That is something Sinclair has left to others in the past. If it wishes to make an impact on business users, it will have to offer it itself from the beginning.

Finally, with this being 1984, with all its Orwellian connotations, we can expect much detailed consideration of the impact of computers on our lives. They are not the frightening, dangerous things they were once regarded but there are still difficulties in learning how to deal with changes they will bring. Perhaps fears of the complete 1984 society will help to provide some answers.


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An experimentation "window" that allows you to try-out your UDG ideas during development of the 84 graphic character set.

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The dedicated programmer will want to use it in conjunction with our ZX SPECTRUM JOTTER PAD — THE ORIGINAL (AND BEST) GRAPHICS PLANNING PAD!

So why not place your order today?

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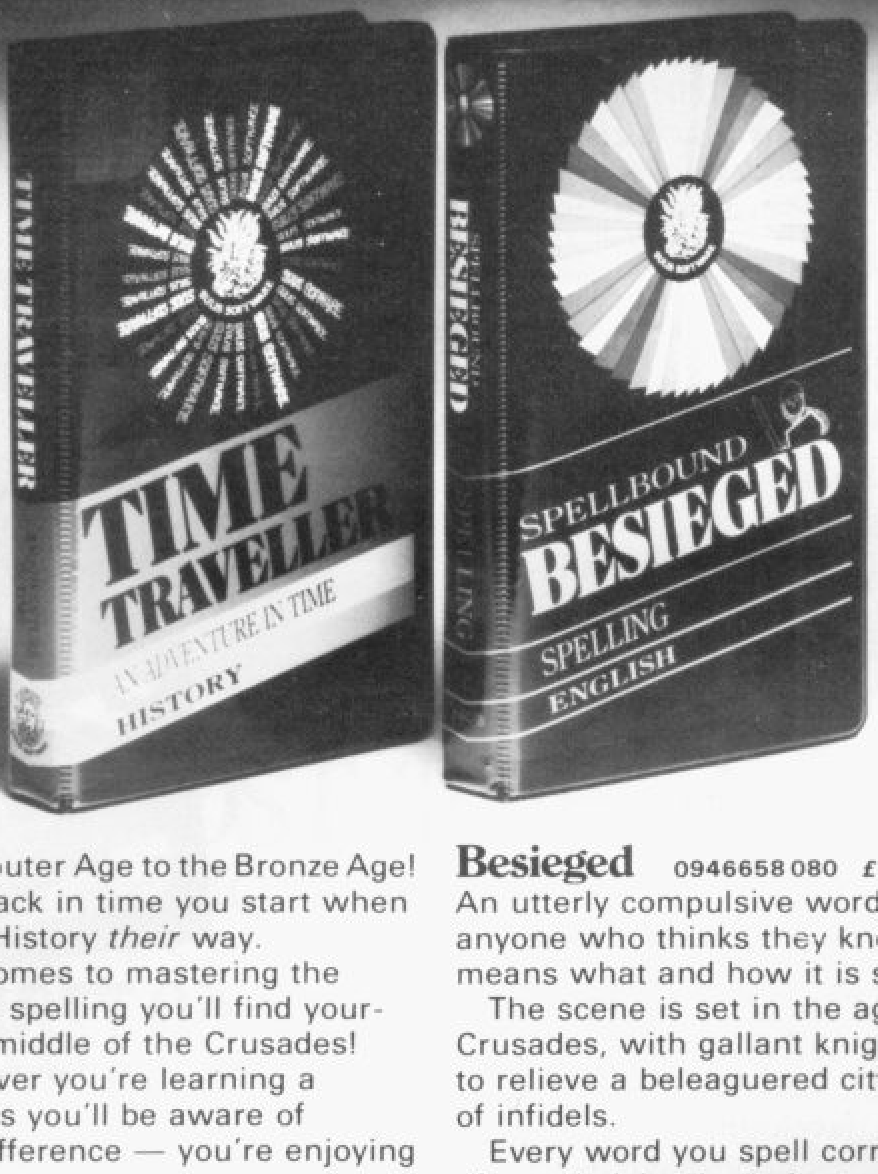
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Two exciting games from Sulis that turn the clock back years



From the Computer Age to the Bronze Age! That's how far back in time you start when Sulis teach you History *their* way.

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In fact, whenever you're learning a subject with Sulis you'll be aware of another major difference — you're enjoying yourself.

Time Traveller 0946658 34X £9.95 inc VAT
An adventure in time that tests your overall knowledge of British history.

The program contains five exciting chase games in one: a Bronze Age forest with wolves, a Roman fort with legionaries, a Norman cathedral with priests and prelates, a 16th-century ducal palace and a Victorian sewer with rats and germs.

At each stage of the game you have to get your historical facts right before you can slip through the time warp into the next Age.

Besieged 0946658 080 £9.95 inc VAT
An utterly compulsive word game for anyone who thinks they know which word means what and how it is spelt.

The scene is set in the age of the Crusades, with gallant knights attempting to relieve a beleaguered city from the grasp of infidels.

Every word you spell correctly helps one of your knights in their struggle. Spell a word wrong and the infidels will have the advantage.

Both of these educational games are available for use on the ZX Spectrum and can be obtained from W H Smith or any other good bookshop or computer store.

Sulis Software

Sulis Software is marketed by John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex PO19 1UD, England

Lucky bag heralds the new year for members

For only £2 you will receive five cassettes to accompany any hardware or software order this month

CLUB BENEFITS

Bi-monthly club cassette available to all club members.
Special discounts on hardware, software and books.
Members recover their membership fee many times over.
Free Club software.
Machine code teach-in.
Telephone Helpline.
Technical advice.

AS A SPECIAL new year offer to Club members we are giving away, for a nominal £2, a cassette lucky bag with any orders. Each bag will contain five cassettes, some of which will be among the top tapes for the Spectrum and ZX-81.

At that price we cannot guarantee the quality but there is a good chance you will be lucky.

In our main offer we have hardware and software items. The Currah Microspeech unit can be added to the back of the Spectrum and, when it is hooked to a television set, it will produce speech through the speaker. The unit can say almost anything and to program it all you have to do is put what you want it to say in a variable.

The Microspeech is even more attractive because many software companies are using its capabilities in their software. The unit is offered at 10 percent off the normal price.

We are also offering a range of games from PSS, a major software house, for the ZX-81 and Spectrum. They include **Maze Death Race** in which you drive your supercharged racer through a giant maze, and **Panic,** a game in which you have to knock your enemies into holes you have just dug.

Also included from PSS are two traditional arcade games, **Krazy Kong,** which entails rescuing a girl from King Kong, and **Hopper,** a bright and exciting version of Frogger.

As usual, the offers are available only to members of the Club and they will be available until the end of January. New members should order along with their applications.

	Usual price	Offer price
Spectrum		
Currah Microspeech unit	**£29.95**	**£26.95**
PSS		
Panic	**£5.95**	**£5.06**
Maze Death Race	**£4.95**	**£4.21**
Krazy Kong	**£5.95**	**£5.06**
Hopper	**£5.95**	**£5.06**
ZX-81		
Maze Death Race	**£3.95**	**£3.36**
Krazy Kong	**£3.95**	**£3.36**
Hopper	**£3.95**	**£3.36**

A chess offer that the ladies cannot refuse

WE HOPE all the males will forgive us if we concentrate mainly on the girls this month. Are computers taking over from the more accepted domestic pastimes? Unfortunately not. Checking our records we were amazed to find that fewer than seven percent of our club members are female.

That seven percent seems to be active. One of the games on the club cassette is an original game, **Mermaid,** which was contributed by Marietta Everett. Perhaps that will encourage more to participate in the Club.

To tempt them even more, we make an offer they cannot refuse. To every female who applies for membership this month we will send a free Mikro-Gen **ZX Chess** program for the ZX-81 or a Mikro-Gen **Masterchess** program for the Spectrum.

Mikro-Gen is participating in the offer as part of its promotion of Masterchess, which has recently had an on-screen digital clock and an opening book of 5,000 moves added to one of the best chess programs available.

The offer will mean effectively that Club membership will cost only £5, as the chess programs are worth £7. Combine that with all the advantages of the club, including special offers, bi-monthly club cassettes, newsletters, telephone help line and technical advice, and clearly it will be the best value for £12 you have ever spent.

MEMBERSHIP FORM

I wish to join the Sinclair User Club and enclose my subscription of £12

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ZX-81 ☐ Spectrum ☐

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Sinclair User Club

Britain

Aylesbury Computer Club: 12 Long Plough, Aston Clinton, Aylesbury, Bucks.

Aylesbury ZX Computer Club: Ken Knight, 22 Mount Street, Aylesbury (5181 or 630867). Meetings: first Wednesday and third Thursday of the month.

Basildon: Roundacre Microcomputer Users' Club. J Hazell, Basildon 285119/416333. Meetings every Wednesday 7.30 to 10.30pm.

Bristol Yate and Sodbury Computer Club: 99 Woodchester Yate, Bristol, BS17 4TX.

Colchester Sinclair User Group: Richard Lown, 102 Prettygate Road, Colchester CO3 4EE.

Crewe and Nantwich Computer Users' Club: J E A Symondson, 46 London Road, Stapeley, Nantwich, Cheshire CW5 7JL.

Doncaster and District Micro Club: John Woods, 60 Dundas Road, Wheatley, Doncaster DN2 4DR; (0302) 29357. Meetings held on second and fourth Wednesday of each month.

Eastwood Town Microcomputer Club: E N Ryan, 15 Queens Square, Eastwood, Nottingham NG16 3BJ.

Edinburgh: Edinburgh Home Computing Club. John Palmer (031 661 3183) or Iain Robertson (031 441 2361).

EZUG-Educational ZX-80-81 Users' Group: Eric Deeson, Highgate School, Birmingham B12 9DS.

Furness Computer Club: R J C Wade, 67 Sands Road, Ulverston, Cumbria (Ulverton 55068). Meets every other week on Wednesday evenings.

Glasgow ZX-80-81 Users' Club: Ian Watt, 107 Greenwood Road, Clarkston, Glasgow G76 7LW (041 638 1241). Meetings: second and fourth Monday of each month.

Gravesend Computer Club: c/o The Extra Tuition Centre, 39 The Terrace, Gravesend, Kent DA12 2BA. Bi-monthly magazine and membership card.

Hassocks ZX Micro User Club, Sussex: Paul King (Hassocks 4530).

Inverclyde ZX-81 Users' Club: Robert Watt, 9 St. John's Road, Gourock, Renfrewshire PA19 1PL (Gourock 39967). Meetings: Every other week on Monday at Greenock Society of the Deaf, Kelly Street, Greenock.

Keighley Computer Club: Colin Price, Redholt, Ingrow, Keighley (603133).

Lambeth Computer Club: Robert Barker, 54 Brixton Road, London SW9 6BS.

Liverpool ZX Club: Meetings every Wednesday 7pm at Youth Activities Centre. Belmont Road, Liverpool 6. Details from Keith Archer, 031-236 6109 (daytime).

Manchester Sinclair Users' Club: Meets every Wednesday, 7.30pm, at Longsight Library, 519 Stockport Road, Longsight — 061-225 6997 or 061 445 6316.

Merseyside Co-op ZX Users' Group: Keith Driscoll, 53 Melville Road, Bootle, Merseyside L20 6NE; 051-922 3163.

Micro Users' Group: 316 Kingston Road, Ewell, Epsom, Surrey KT19 0SY.

Newcastle (Staffs) Computer Club: Meetings at Newcastle Youth and Adult Centre, Thursday, 7.30 to 10 pm. Further information from R G Martin (0782 62065).

North Hertfordshire Home Computer Club: R Crutchfield, 2 Durham Road, Stevenage; Meetings: first Friday of the month at the Settlement, Nevells Road, Letchworth.

Northern Ireland Sinclair Users' Club: P Gibson, 11 Fitzjames Park, Newtownards, Co Down BT23 4BU.

North London Hobby Computer Club: ZX users' group meets at North London Polytechnic, Holloway Road, London N7 each Monday, 6pm.

Nottingham Microcomputer Club: ZX-80-81 users' group, G E Basford, 9 Holme Close, The Pastures, Woodborough, Nottingham.

Nottingham ZX Spectrum Club: Would like to hear from new members. D Beattie and P Riley, 53 Kingsley Crescent, Sawley, Long Eaton, Nottingham NG10 3DA.

Orpington Computer Club: Roger Pyatt, 23 Arundel Drive, Orpington, Kent (Orpington 20281).

Perth and District Amateur Computer Society: Alastair MacPherson, 154 Oakbank Road, Perth PH1 1HA (29633). Meetings: third Tuesday of each month at Hunters Lodge Motel, Bankfoot.

Regis Amateur Microcomputer Society: R H Wallis, 22 Mallard Crescent, Pagham, Bognor Regis, West Sussex PO21 4UU.

Roche Computer Club: 8 Victoria Road, Coop Rooms, Roche, Cornwall: 0726 890473.

Scunthorpe ZX Club: C P Hazleton, 26 Rilestone Place, Bottesford, Scunthorpe; (0724 63466).

Sheffield: South Yorkshire Personal Computing Group. Enquiries to R Alderton (0742 20571), S Gray (0742 351440), P Sanderson (0742 351895).

Sittingbourne: Anurag Vidyarth (0795 73149). Would be interested to hear from anyone who wants to start a club near the Medway towns.

St Albans: Bi-monthly meetings and a magazine. Details from Adam Slater, 40 Watford Road, St Albans, Herts AL1 2HA. Telephone: 0727 54176.

Stratford-on-Avon ZX Users' Group: Chris Parry, 16 Sackville Close, Stratford-on-Avon, Warwickshire.

Swansea Computer Club: B J Candy, Jr Gorlau, Killay, Swansea (203811).

Swindon ZX Computer Club: Andrew Bartlett, 47 Grosvenor Road, Swindon, Wilts SN1 4LT; (0793) 3077. Monthly meetings and library.

Sutton: Sutton Library Computer Club, D Wilkins, 22 Chestnut Court, Mulgrave Road, Sutton, Surrey SM2 6LR.

West Sussex: Midhurst and District Computer User Group. Enquiries to V Weston (073 081 3876), R Armes (073 081 3279).

Worle Computer Club: S W Rabone, 18 Castle Road, Worle, Weston-super-Mare BS22 9JW (Weston-super-Mare 513068). Meetings: Woodsprings Inn, Worle, on alternate Mondays.

ZX-Aid: Conrad Roe, 25 Cherry Tree Avenue, Walsall WS5 4LH. Please include sae. Meetings twice monthly.

ZX-80/ZX-81 Users' Club: PO Box 159, Kingston-on-Thames. A postal club.

Overseas

Austria: ZX User Club, Thomas Christian, c/o Wissenschaft Forscht e. V., Postfach 141, A1190 Vienna. Meets every first Friday of the month. Telephone 0222-44 32 050 for details.

Belgium: ASBL BDMA Belgium National Sinclair Club; P Glenisson, Rue De l'Epeestraat, 14, 1200 Bruxelles.

Belgium, France and Luxembourg: Club Sinclair, Raymong Betz, 38 Chemin du Moulin 38, B-1328 Ohain, Belgium (322 6537468).

Belgian User Group for Sinclair owners (BUGS); Op de Beeck, Patrick, Drabstraat 144, 2510 Mortsel.

Micro-Europe Club; R Betz, Chemin du Moulin, B1328, Ohain, Belgium. Telephone: CCP 000 0846556-37.

Denmark: Danmarks National ZX-8081 Klub (DNZK), Jens Larson, Skovmosevej 6.4200 Slagelese, post giro 1 46 24 66.

ZZ-Brugergruppen i Danmark, Boks 44, 2650 Hvidovre, Gratis medlemskab og gratis blad til enhver interesseret.

J Niels-Erik Hartmann, OZ-ZX-Radioamator, Bruger Gruppe, Bredgade 25 DK-4900, Nakskov.

East Netherlands: Jonathon Meyer, Van Spaen Straat 22,6524 H.N. Nijmegen; (080 223411).

Germany: ZX-80 Club, a postal club; contact Thomas Jencyzyk. Hameln, Postfach 65 D-3250 Hameln, Germany.

Indonesia: Jakarta ZX-80/81 Users' Club, J S Wijaya, PO Box 20, Jkukg, Jakarta, Utara, Indonesia.

Irish Amateur Computer Club: Martin Stapleton, 48 Seacourt, Clontarf, Dublin 3. (331304).

Italy: Sinclair Club, Vie Molimo Veccho so/F, 40026 Imola, Italy.

Genova Sinclair Club; Vittorio Gioia, Via F Corridoni, 2-1, telephone 010 3125 51.

Micro-Europe: Belgium or Club Paris-Micro, 19 Rue de Tilly, 92700, Colombes, France; associated with Club Micro-Europe.

Republic of Ireland: Irish ZX-8081 Users' Club, 73 Cnoc Crionain, Baile Atha, Cliath 1.

Singapore: Sinclair Users' Group: Eric Mortimer, 1D Wilmer Court, Leonie Hill Road, Singapore.

South Africa: Johannesburg ZX-80-81 Computer Users' Club: S Lucas, c/o Hoechst SA (Pty) Ltd, PO Box 8692, Johannesburg.

Johannesburg ZX Users' Club: Lennert E R Fisher, PO Box 61446, Marshallstown, Johannesburg.

Spain: Club Nacional de Usuarios del ZX-81, Joseph-Oriol Tomas, Avda. de Madrid, No 203 207, 10, 3a esc. A Barcelona-14 Espana. International ZX Spectrum Club: Gabriel Indalecio Cano, Sardana, 4 atrico 2a, San Andres de la Barca, Barcelona. Send international reply coupon. Produces a bi-monthly magazine. Spanish ZX Micro Club: Apartado 181, Alicante (Costa Blanca), Spain.

ZX Club Spain; C Benito PO Box 3253, Madrid, Spain.

Swedish ZX-club: Sinclair Datorklubben, Box 1007, S-122, 22 Enskede, Sweden.

United States: Bay Area ZX-80 User Group, 2660 Las Aromas, Oakland CA94611.—Harvard Group, Bolton Road, Harvard MA 01451: (617 456 3967).

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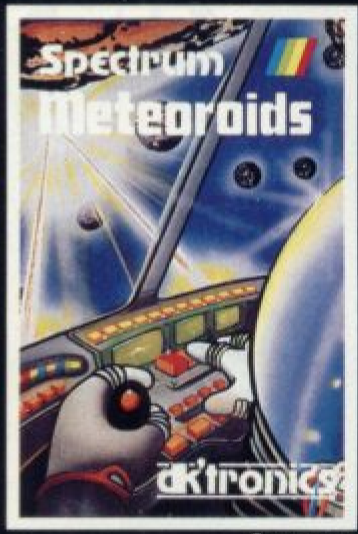
See page 140 for further details and order form.



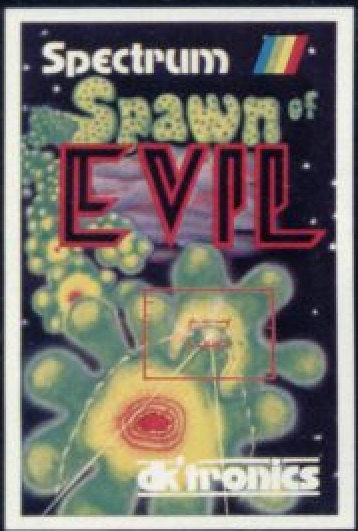
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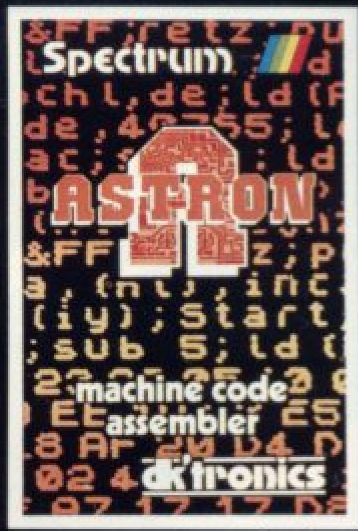
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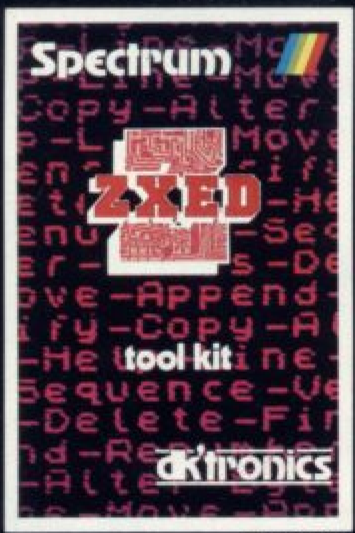
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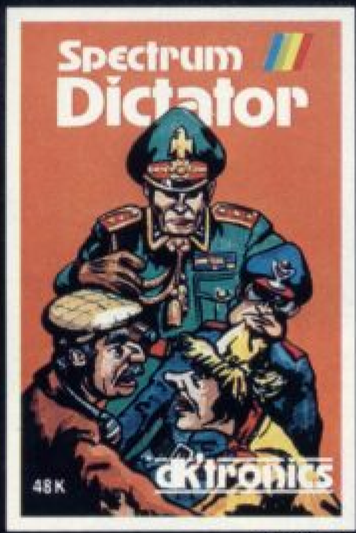
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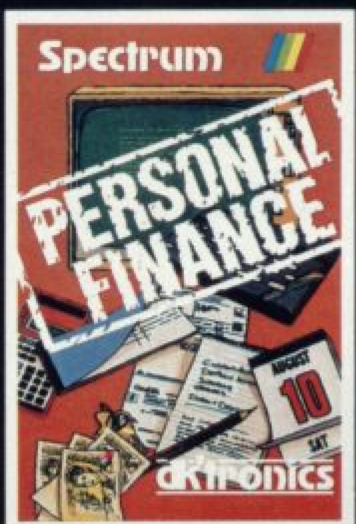
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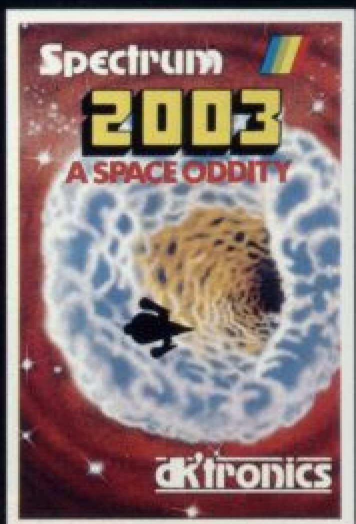
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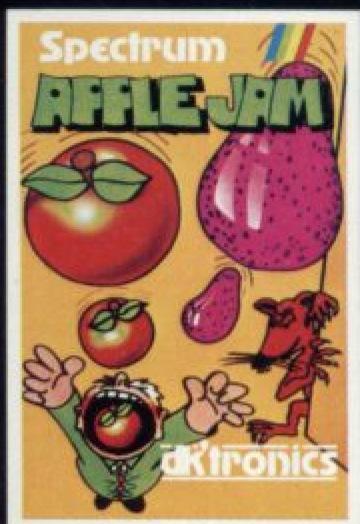
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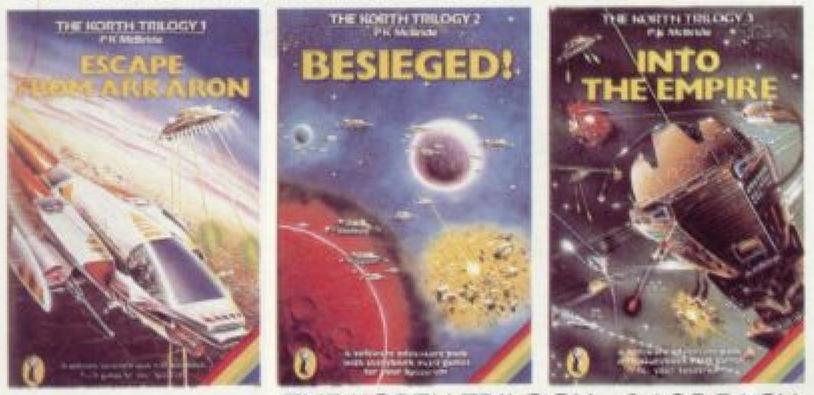
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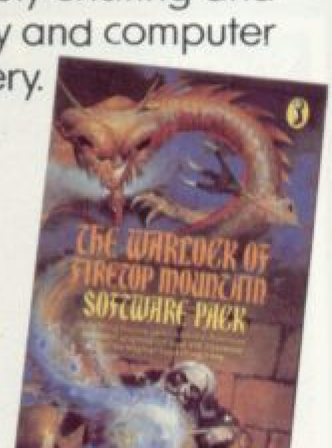
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Fault on model three denied

SINCLAIR RESEARCH has answered suggestions that the model three Spectrum is incompatible with some software on the market. The company says that no major range of software has been affected, so far as it knows, by the change in the ULA reported several months ago.

It adds that the operation of the Spectrum has in no way changed and it is through the assumptions of some software houses that difficulties have occurred.

Problems have occurred with some software because it was taken for granted that the values from the three higher-order bits from bytes coming from the keyboard will always be one. That assumption is not correct and the company thinks it unwise to take such a thing for granted.

Bugs to be rectified

ODYSSEY COMPUTING, producer of ZX-81 high-resolution games and utilities, has been having difficulty with two items in its range. The tapes in question are **High-Resolution Zorf** and **High-Resolution Graphics** in which there are several bugs.

The company is doing its best to rectify the situation and will offer money back to customers who have a faulty version of the programs.

It also warns that customers may wait for new tapes or for the fulfilment of orders but it cannot state definitely when the programs will be ready for re-release.

If customers have queries they should write to Odyssey Computing, 28 Bingham Road, Sherwood, Nottingham, NG5 2EP. Alternatively they can write to the advertising department of *Sinclair User*.

Copyright question remains open

SETTLEMENT talks have been concluded between Atari and Namco on the one hand, and Philips and Commodore on the other. Atari claimed in October that the Philips Munchkin program and the Commodore Jellymonsters infringed its copyright of Pac-Man. It was widely expected that a legal ruling on the case would establish a precedent on software copyright but the parties concerned decided to settle out of court, leaving the question open again.

Although at present the law specifically forbids pirating of tapes, the line between plagiarism and the fair use of available material has not been clearly defined. Several recent cases involving copyright have been settled out of court but it is thought that the forthcoming Filetab Support Services case against the National Computer Centre about the use of Usertab and Filetab may give a few pointers.

A Bill to give explicit copyright protection to computer programs will be introduced by Lord Lloyd to Parliament in this session. "It is a piecemeal piece of legislation," says a leading computer software specialist, "and it is unlikely to go through because of its knock-on effect on other laws. It may force the Government to issue a policy statement on software copyright but it may take two years before we see definite changes in the law."

New anti-piracy device

A NEW DEVICE to prevent software piracy has been invented by Professor Adi Shamir at the Weizmann Institute of Science in Israel. It would be applicable mainly to disc units of bigger micro-computers but it could also help to prevent piracy of telesoftware on databases and networks, such as Micronet 800, which have hundreds of small computers logging into them every day.

Where it differs from other types of software anti-piracy devices is that it will also allow a manufacturer to limit the amount of times a program is used.

The system prevents copying by taking into account the relative weakness of a signal which has been copied from one storage medium to another. Professor Shamir says:

"The beauty of the system is that it is cheap to implement and does not require modification of computers already on the market."

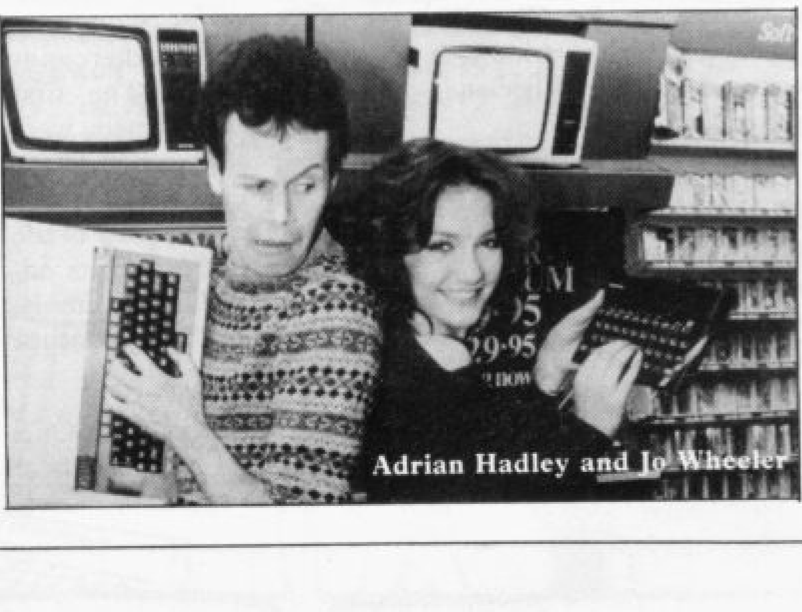
Mike Johnston, secretary of the Guild of Software Houses, was pleased to hear of the new device, which could be of benefit to some members of the group. He says:

"My first reaction is that it will be of some use and I would like to hear more about it. New security devices such as this are needed all the time, because no sooner are they in operation than some bright spark has cracked them."

Computers star in TV shows

THE COMPUTER BOOM is taking over on television, following the introduction of the BBC Computer Programme two years ago.

The Thames Television series Database, hosted by Tony Bastable, has just finished and Central Television has a series along similar lines. It is called Magic Micro Mission and is hosted by Adrian Hedley and Jo Wheeler. Hedley plays the captain of the show and leads the cast and guests on a journey in a spaceship through the world of computers.



Adrian Hadley and Jo Wheeler

Yorkshire Television is now thinking of producing its own show. The company is seeking users who have applied their computers to strange tasks, such as feeding a dog and blowing up balloons.

More information can be obtained from Yorkshire Television, The Television Centre, Leeds LS3 1JS.

Expansion in Europe being planned

DURING a conference for overseas distributors in Cambridge and a conference tour of European countries, Sinclair Research has given details of its sales plans for the European market, including the introduction of the Interface One and Microdrive.

The marketing details for the devices were discussed with respect to the countries visited, which included France, West Germany, Sweden, Italy and Spain.

Sinclair also introduced several new computer ventures in the countries visited. In Paris, the company displayed a new special interface designed to enable customers to use the Spectrum with the SECAM television system. Until now potential customers have not been able to buy Spectrums in Britain because of the differences in the television systems.

The Stockholm conference featured a new keyboard device which will allow the use of extra letters in the Swedish alphabet to be used in programs.

Sinclair Research intends to make Europe and the other international markets, such as the U.S., its top priority. It visualises 300 million potential customers in Europe.

Nearly 40 percent of Sinclair computers are produced for export and Sinclair will continue with that plan. It anticipates making £1.5 billion with the European figures taken into account this year. Nigel Searle, managing director of Sinclair Research, says:

"We place tremendous importance on exploring new markets for Sinclair products. The U.K. now holds the number one position in *per capita* ownership of personal computers and our experiences at home can and will be utilised in export markets.

Software building up for Microdrive

ORDERS fulfilled for Interface One and Microdrives have not yet passed the 1,000 mark but some companies are adapting their existing software to work with the Microdrive.

Richard Shepherd Software is selling **Cash Controller** with an extra menu option for Microdrive storage and retrieval.

The immediate advantage is that the program can be saved on to Microdrive and recalled quickly but little seems to have been done to increase the amount of data which can be retrieved by the program. The other company using Microdrive is Campbell Systems and its data storage programs is **Masterfile.** It has been adapted so that the user can store and recall data on to the cartridge and modification to the existing program is minimal.

According to Sinclair Research, several companies have shown interest in putting software on to Microdrive cartridge.

Development has been hampered by the lack of cartridges available, although Sinclair hopes to arrange with software houses about the distribution of software on cartridge in the near future.

Orders for the Interface One and Microdrive are still being completed slowly as Sinclair does not want to hurry a process which may cause difficulties.

A spokesman for the company says that from what information it has, one in 10 people ordering bought only an Interface One. That is surprising, as most customers will not have access to two interfaces and would not be able to use the RS232 and networks which it supplies.

Cambridge Award presented

THE CAMBRIDGE Award Trophy for programming, co-sponsored by *Sinclair User* and Cases Computer Simulations, was presented to Mark Lucas at the ZX Microfair at Alexandra Palace, London.

His program, **Battle 1917,** is a war simulation for the Spectrum. As well as receiving the trophy, Lucas collects a cheque for £1,000 and the royalties from his program which will be marketed by Cases Computer Simulations. He was also treated to a champagne dinner by one of the representatives of the software company.

The second prize for the Spectrum was for **War 70,** also a battle simulation was written by Mike Wheeler, a reader from Sale.

The second prize for ZX-81 software went to John Sherry of Keele, Staffs for his program **Broodslayer,** an adventure game for the 16K machine. The ZX-81 and Spectrum prize winners each received £250. Third prize for a Spectrum game went to N. Holgate of Camberley, Surrey for **Oligopoly,** a game of skill and intrigue set in the world of business. For the ZX-81 the third prize was won by Christopher North, 2 Connaught Terrace, Southend, Bedall, North Yorkshire for another adventure called **Barrows Quest.** The third place winners received £100 each.

Nigel Clark, managing editor of *Sinclair User* and joint chairman of the judges says: "We were impressed with the level of entries. We are planning to run another competition along the same lines soon."

Melvyn Lloyd-Jones, a director of Cases Computer Simulations, the other joint chairman, says: "The first two Spectrum winners were close, but the deciding factor which lead us to select Battle 1917 was the simplicity of the rules which added to its addictiveness." There were 10 runners-up for the Spectrum and ZX-81.

Each will win five CCS programs and a free annual subscription to *Sinclair User.*

Spectrum: Blocked In, D. Milwain, Oldham, Lancashire; Mummies and the Crown, C. Headley, Waybridge, Surrey; Dominoes, K. Fisher, Buxton, Derbyshire; Magic Jokers, C. Powell, Wembley, Middx; Dark Realm, P. Damaa, New Malden, Surrey; Diver, P. Caris, Farlington, Beds; Heart Attack, C. North, Southend, Bedall; Harry Goes Home, A. Bond, Rumsan, Banstaple; Treasure Island, A. Clenson, Wolverhampton; Toyland, C. Jones, St. Annes-on-Sea, Lancs. ZX-81: Boxes, W. Blackburn, Sharples, Bolton; Survival Maze, James Rowntree, Chester, Cheshire; Hildas Revenge, S. Walters, Cannock, Staffs; Convoy, J. Entwistle, Cheltenham, Gloc.; Pipeline, M. Moor, Crayford, Dartford; The Andromeda Trophy, M. Brooker, Broadhead, Strand; Marvin the Monopolist, D. Warner, Wolverton, Milton Keynes; Striking a Spark, J. Lowther, Hey Wood, Lancs; Barons, Haxby, Yorks; Tower of Evil, J. Cullingham, Crowthorn, Berks.

Sinclair aims for new BBC contract

SIR CLIVE SINCLAIR intends to fight Acorn Computers, and others, for the contract to build the new BBC computer. The contract will be awarded to the winner in the autumn and the BBC is already having consultations with Acorn.

Sinclair Research has fought for the contract twice already and the Spectrum could have been the first BBC computer if Acorn had not made a deal with BBC first. Sir Clive, however, is confident that he can win this time. He has submitted a request for the specifications of the projected new machine.

One of the things which could win Sinclair the contract is its impressive sales record, with sales of the Spectrum reaching beyond the million mark. The more expensive BBC micro has sales of about 200,000.

ZX-81 sales are still going strong

FEARS about the demise of the ZX-81 and the 16K Spectrum have been quashed by Sinclair Research. A spokesman for the company says: "About six months ago we thought that the ZX-81 would not last for much longer and we thought about winding-down its manufacture.

"We have no date for a wind-down now, as the machine has gone from strength to strength. We hope it will continue to sell well in the first few months of the year. We think sales will now be concentrated in third world countries, with demand falling in the U.K."

There are no plans to drop the 16K Spectrum. Sinclair Research will continue to sell the machine but it cannot confirm that individual suppliers will continue to provide stocks to retailers. A spokesman for the company says:

"We have no plans to cease production but sales have shown that the 48K Spectrum is out-selling the 16K version by four to one. None of the big retailers, such as W H Smith, has shown any inclination to drop the machine from stocks."

Joint educational programs launch

FORMER Prime Minister Harold Macmillan was guest of honour at the launch of a new range of educational software produced by Sinclair Research in conjunction with Macmillan publishing.

His family founded the company 140 years ago and he spoke of the great technological advances in his lifetime. "What is said is still as important as the method of saying it," he commented.

The nine initial programs in the range are based on the widely-used Macmillan Educational school textbooks.

Two software houses, Five-Ways Software and Fisher-Mariott, were involved in developing the programs which sell at £9.95 each.

Although Sinclair Research plans to expand its Macmillan software range, a company spokesman says it will also be producing educational programs in conjunction with other firms.



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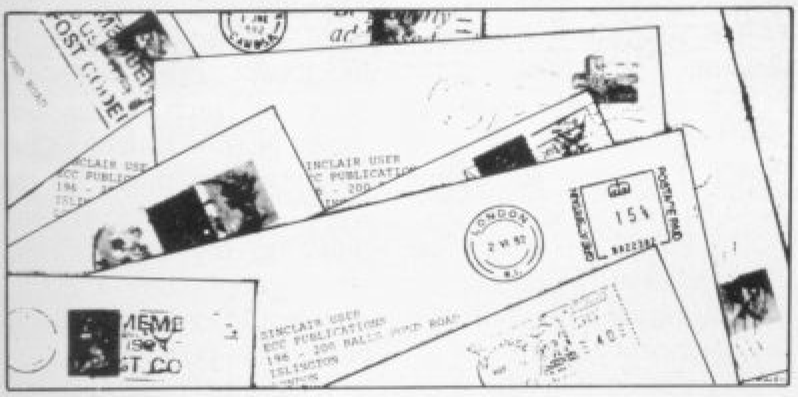
Sinclair ZX81 1K/16K — **£19.95**

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You will meet friends and enemies, old and new, in the long awaited sequel to Volcanic Dungeon. Using high resolution graphics and combining the best qualities of "Black Crystal" and "Volcanic Dungeon", we will allow you to become part of this tale of revenge.
"The Wrath of Magra" comes as three, 48K programmes on cassette, boxed with instruction manual and book detailing the history of the Third Continent and the many spells you will be using throughout the game. For the 48K Spectrum @ £12.50.
NOTE: "The Wrath of Magra" is a complete adventure. You need not buy "Volcanic Dungeon" or "Black Crystal" to play it.
Available from Feb '84
CARNELL SOFTWARE LTD



Hooked on the worm game

I AM HOOKED. I have been playing with the Worms game for the last seven months, at least six hours a week.

I have finally conquered it. Could I be a world record-holder with a score of 260,850, completing stage seven successfully?

**Mark Appleby,
Camberley,
Surrey.**

Friendly suggestion

I AM WRITING to say how much I enjoy reading your magazine. I buy it every month to do the programs for the Spectrum.

My friend made up a program. I thought you might like to try it. 10 PLOT 127, 88: DRAW 50, 50, 788. To change the program you change the last numbers.

My favourite game is the Worms game on which I have scored 150,765.

**D Axtell,
Nottingham.**

Scoring on all fronts

I THOUGHT I would tell you my high scores on ZX Scramble (Mikrogen) Mazogs (Bug-Byte) Lunar Rescue (Mikrogen) and Zuckman (OSL), on the ZX-81.

ZX Scramble, 3660; Mazogs, 92 percent; Lunar Rescue, 15,280; Zuckman, round the clock once plus 1,442, I think that is 101,541.

**Jonathan Slatter,
Cannock Wood,
Staffs.**

Orbiter record under attack

I HAVE a 48K Spectrum and I have bought the Silversoft Orbiter. I have achieved a score of 244,050. I played the game for 45 minutes and I had completed 14 attack waves. Is it a record?

**Michael Pascall,
Brentwood,
Essex.**

Cookie gets high score

I HAVE scored on Cookie 51,825 and I reached level 11. I saw that someone said that they did not like Cookie, but I do. I think it is the best game we have so far.

**Matthew Garrett,
aged 8,
Bedford.**

A routine discovery

I AM WRITING about a routine I discovered while experimenting with the POKE statement on my 16K ZX-81. The routine has the effect of 'slurring' the characters of the '81, allowing 'impossible' graphics. As the routine is so small I have not taped it. The listing is:

```
10 POKE A,N
20 POKE A+1, 200
```

where A is the desired location and N the character code. An example would be:

```
10 POKE 16800,1
20 POKE 16801,200
```

That would give a vertical, one-pixel wide, line near the middle of the screen. The routine will work only on the 16K ZX-81.

**D Read,
Ashby de la Zouch,
Leicestershire.**

Shortcomings pointed out

I HAVE OWNED a ZX-81 for nearly two years and had great success from the start. In April, 1982 I heard about *Sinclair User* and hurriedly ordered my issue. You do a marvellous job, as most of your readers must agree, but there are some points I would like to make.

In the Attack program p.72, October 1983 — you stated it was for the 16K ZX-81 but when has BORDER, INK, PAPER, BRIGHT, READ and DATA been available on the ZX-81? I know it is easy to make mistakes but please do not do it again. After converting it to work on the ZX-81 it worked perfectly.

I can scarcely read some parts of the program listings made with your new printer. Why not treat it to a new ribbon?

About the early retirement for Corner Man, I met him in Oxford recently and he told me that you made him redundant. I beg you, give him back his job.

Andrew Hewson should have more pages and so should that Forth stuff.

I have access to a Jupiter Ace at school and I would recommend Forth to anyone who is interested in learning different languages.

On the other hand, if I told you all my compliments on *Sinclair User* you would need a whole issue for just my letter.

Finally, if anyone is interested in having a pen friend who has a ZX-81, I would be more than delighted to swap views, letters, tips and programs.

May *Sinclair User* live for ever.

**Michael Boxwell,
aged 13,
2 St Leonards Close,
Watlington,
Oxford.**

Greed threatens home micros

AS I ENJOY your magazine and always buy it, I would like to make the following comments:

The home micro industry at the moment has an unacceptable face to it.

It is one gigantic rip-off and I am waiting for the first magazine to expose it as such.

Most software is incredibly poor in quality and not worthy of any type of professionalism.

Shops are hell-bent on creaming-off the profits while the going is good on this no-refund, no-service product market.

Please discontinue your top ten as I suspect certain stores have an interest in promoting sales of particular cassettes.

Please continue with your software review and listings.

How about an article on software houses? I rate Melbourne House highly.

Please, please save the home micro industry before it self-destructs in a welter of greed.

**B Plowman,
Matlock,
Derbyshire.**

More letters on page 26

Disreputable advertisement

I HAVE just bought my usual copy of *Sinclair User* and I am somewhat horrified to see an advertisement which appears to be selling pornographic programs. Apart from producing such programs in the first place, I think that such material might well be left to find more suitable outlets. Second, whether the programs are pornographic or not in content, the inference of the advertisement is that they are, and there is no age warning. I think that there are three point which should be made:

Sinclair User is read by a very large minor audience, my daughters included, aged eight and 12. I am sure that there are many parents who will be as keen as I am to keep children away from such material.

The lack of age limits indicates that minors and adults alike will be able to purchase the programs which are, by and large, well within the 'pocket-money' market. I would question the legality of this situation.

Do you not think that a magazine of your reputation would have been better keeping away from material like that? I should have thought that if anyone wants sex games they would be better writing their own or at least have to look for such things in the adult press.

Obviously I shall have to switch to another magazine if anything of a pornographic nature is to appear again. Unfortunately, I have recommended *Sinclair User* to a large number of people and I hope that there will be no repercussions over this latest issue.

For my part, as a computer consultant, I feel that anything which brings computing into disrepute is harmful to the industry as a whole. We had enough trouble in the '60s and early '70s with bad salesmanship to last a lifetime. Now these machines are achieving their correct place in society after all the years of mystique, I am very disappointed to see the advertising of pornography which cannot do the industry any good.

I, and probably many others, would like to know your policy on this matter, particularly your future policy.

G S Kinnear, Hartford, Cheshire.

● *We agree with your comments and we published an apology in our last issue. In the rush of producing a magazine some things can be overlooked and unfortunately that is what happened in this case. We took immediate action to ensure that it did not appear again and we will do our best to make sure it does not happen again.*

Cheap graph paper sought

I OWN a 48K Spectrum. The Print 'n' Plotter jotter is the only graph paper of which I know that is the same size as the Spectrum screen i.e. 8×8 squares and 176×256 overall. At £9.95 it is too expensive for me. Normal graph paper has 10×10 squares and is not suitable for designing Hi-res screen layouts.

Does anyone know where I can obtain some suitable graph paper at a reasonably cheap price?

Here is a list of POKEs I find useful when programming:

POKE 23609,25 — sets the keyboard beep.
POKE 23658,8 — sets caps lock on
POKE 23658,0 — re-sets caps lock off
POKE 23662,1 — allows line 22 to be printed on.
POKE 23662,2 — re-sets line 22 to normal. Important — line 22 must be re-set after it has been printed on:

To print on line 23 use 10 PRINT #0;"SINCLAIR USER":GOTO 10.

Michael Horgan, Isleworth, Middlesex.

Technological retreat

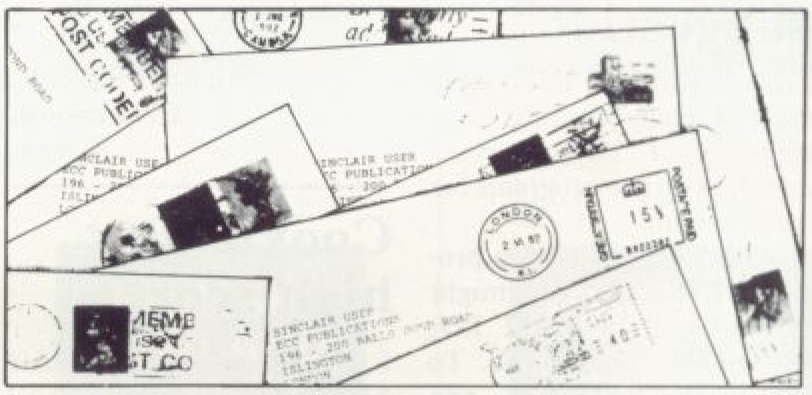
CAN YOU remember when the first calculators appeared? Soon they were advanced and had touch-sensitive keyboards. The price of that type of calculator was substantially higher than the normal.

When computers reached the market they, too, had 'typewriter-style' keyboards. One of those computers, the ZX-81, had a touch-sensitive type. You would expect, in line with calculators, the price of such a machine would be substantially higher than other computers but the ZX-81 is the cheapest computer on the market. Even when people buy a ZX-81 they would eventually like to buy an add-on keyboard.

What had once been the best machine to own seems to have changed through the years to be the worst. It has also happened in the short term with computers. Originally computers were vast machines with many valves and engineers tried continually to reduce the size.

Now we seem to change our views again. People buy keyboards with large cases for the Spectrum just to make the computer look bigger and more powerful. What we have set out to reduce we now wish to expand. Are we going forwards or backwards in this age of technology?

Marc Hawes, Ely, Cambs.



Competition unfair to readers

I HAVE decided not to renew my *Sinclair User* subscription as I do not think that you are treating all your readers equally. For example, the competition for the Microdrive is open only to the more experienced.

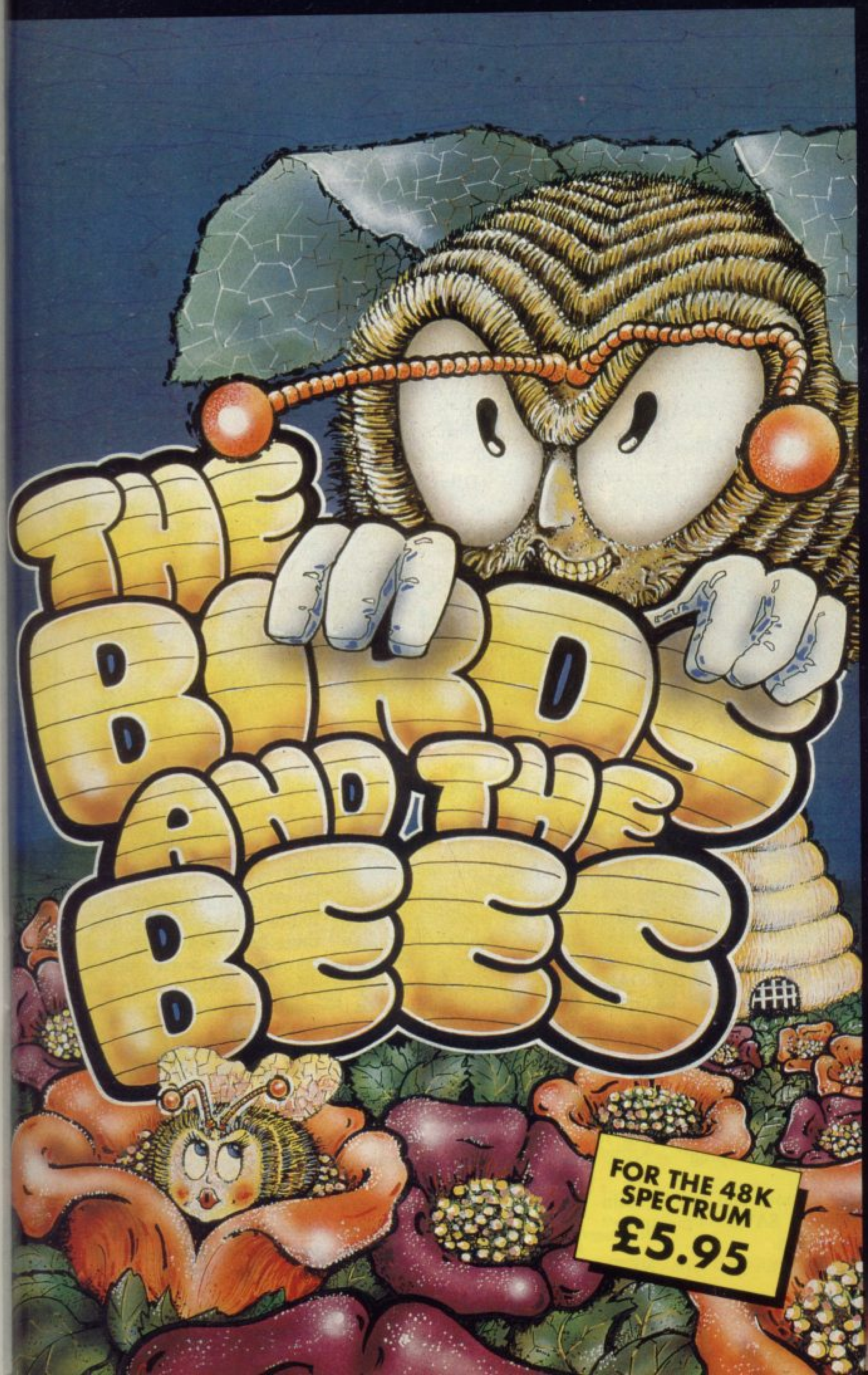
The majority of Sinclair owners as yet could not write a program, far less do your competition, so until you have competitions all your readers can attempt I do not think I should subscribe.

Robert McKinlay, Blairgowrie, Perthshire.

● *We attempt to please as many people as possible in each issue. While the Microdrive competition was limited, it attracted a good deal of interest. Last month we had a competition for users of all machines.*

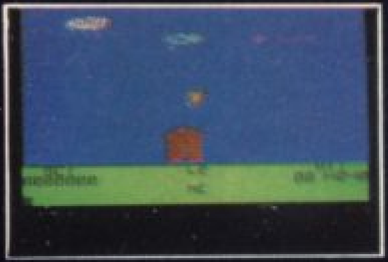
More letters on page 28

BUG-BYTE SOFTWARE





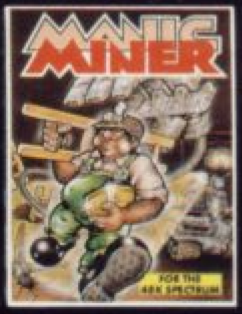


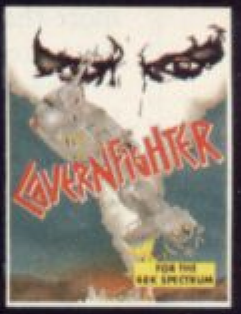


The Birds and The Bees is an original animated cartoon-style game, introducing, for the first time on screen, Boris the Bee. Boris must collect as much nectar as possible, whilst avoiding various nasties like birds, wasps, centipedes and Venus fly traps. Smooth, fast machine-code action throughout, with sound effects, joystick option (most types) and speech option with the Currah Microspeech Unit.

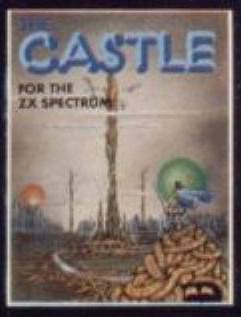
Author: Adrian Sherwin with graphics by Matthew Smith (of Manic Miner fame)

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Registered Dealers can order direct from CBS Distribution on 01-960 2155

Businesslike Spectrum

I WOULD like to say how much I agree with G A Rooker's letter — *Sinclair User*, October — about serious use of the Spectrum. My 48K machine is in constant use in my one-man design business. I use Rooker's Beamscan program and I have written my own program from which I can select construction notes to be printed-out, to save me hours of tedious handwriting on my drawings.

I am heartily sick of the way the business computer world seems to ignore Sinclair computers and dismisses them as mere games machines. There is even a regular computer column in my local paper in which the writer often makes veiled 'anti-comments' about Sinclairs.

The more I learn about the capabilities of the Spectrum, the more I am convinced that there is much left to explore, and I am absolutely convinced that it is not necessary for the small business to contemplate the expenditure of more than £2,000 to install a computer system.

I agree with Rooker that Sir Clive should concentrate on the development of the Spectrum business image before pushing ahead with his projected business computer.

R C Crane,
Burton-on-Trent,
Staffs.

Missing colour mystery

MY PARENTS bought me a ZX-81 in August, 1982 and since then I have been an avid reader of *Sinclair User*.

I am now the owner of a 48K Spectrum Mark II which my parents bought in July. We have two television sets, a Pye 22in. colour set and a 14in. portable Contec less than two years old. I cannot get colour from the Contec set; all pictures appear in black and white and no amount of tuning will help. I discovered this only last week as the Contec stays in Kent during the summer months.

Could any of your readers tell me why my Contec colour television is incompatible with my Spectrum?

Nicholas Fuller,
aged 14,
London EC1.

Integrating machine code

SOME READERS may consider this as egg-sucking advice but others, like me, may have found difficulty in integrating machine code routines with Basic programs. I have found the following procedure effective with the Spectrum:

SAVE Basic program and machine code separately — "mainprog" and "machinecodefile".

Type an initiating program like this — call it "init": 10 CLEAR n: LOAD "machinecodefile" CODE 20 LOAD "mainprog"

SAVE "init" line 10 on main tape. Remove tape but do not wind back.

NEW and put "machinecodefile" into cassette recorder. Type CLEAR n: LOAD "machinecodefile" CODE: RETURN.

Replace main tape and SAVE "machinecodefile" CODE n,n.

Remove tape: put in Basic program ("mainprog"): LOAD "mainprog" — NEW first.

Remove and put in main tape. SAVE "mainprog" LINE n.

To run it, type NEW, wind back and LOAD " "

The main tape then contains the Basic and machine-code programs and thereafter can be loaded in 1; it is also self-running.

One assumes USR lines in the Basic program to enable the machine code routines. Once Microdrive is generally available, perhaps we can forget this hassle.

David Bye,
Saffron Walden,
Essex.

Family tree program

MY SON tells me he has seen an advertisement for a program to make a Family Tree. We cannot find it in any of our copies of *Sinclair User* and I wonder if anyone can let us know if such a program exists for the Spectrum 48K.

Dilys McIntyre,
Camberley,
Surrey.

Display errors corrected

THANK YOU for publishing my article on display in the November issue of *Sinclair User*. Unfortunately there were two errors in one of the lines of diagram three.

Line 370 was printed as LET A$=("."+A$ AND A$ (1 TO 2)="OO")+A$ AND A$ (1)=".")+(A$ (2 TO) AND A$ (1TO2)="0.")

John Armfield,
Bridgwater,
Somerset.

Churning out the aliens

WHEN I BOUGHT a Spectrum 48K a few weeks ago I thought the standard of games for it would be fairly good but nine games out of every 10 available in the shops are childish tripe along the space invaders lines.

I am 35 and want something to tax my intelligence. The cliché games such as chess and backgammon fulfil this slightly but there is tremendous scope for programmers to turn their skill to producing new games. I accuse them of taking the easy way and churning out aliens after aliens after aliens.

What do I think of games software in general? To borrow the title of a program printed in the September issue, Rubbish!

Mike Godwin,
Leicester.

Help needed for software search

I THINK your Software Directory is an excellent idea, with the profusion of programs flooding the market but I think the potential user will be looking for a program for a particular purpose and if you were to catalogue the titles alphabetically, section by section, it would be much quicker to locate the kind of thing one is seeking.

I would like to ask you if you know of a program to enable me to get a cutting list, costing and list of materials from a design of a cabinet after the variables are entered. I know of some available in the States for the purpose but I should imagine someone has produced something here by now, or there may be a Spectrum graphics program which could be modified for this purpose.

G H Anderson,
Bourton,
Dorset.

• *We take your point and are looking at the possibility of re-arranging the list. We do not know of a program of the type you describe but perhaps readers can help.*

Communications taken out of the cradle

MICROMYTE has produced a communications system to use on a home telephone which will allow you to SAVE and LOAD programs to another ZX-81 or Spectrum user at 600 baud. The system consists of a cradle for the normal standard telephone, which has an amplifier and filter in it. The power pack is plugged into it and then a lead taken from the alternate power socket to the computer.

If you have a Spectrum the alternate power socket is a jack plug; if you have a ZX-81 the alternate socket is a Spectrum-type barrel socket. A lead with both kinds of plugs is provided.

A cassette is supplied with the software which does all the work. You must first LOAD it into the computer. The program first lowers RAMTOP — on the Spectrum by 1,535 bytes — and then loads the machine code program above it. Separate programs are provided for 16K and 48K machines. The program can be called at any time during a running program or from the keyboard by using RAND USER 64000 on a 48K Spectrum.

The bottom line is taken over for messages once the machine code routine is entered and (T) transmit or (R) receive appears on the screen. Pressing (R) will start the LOADing routine immediately. That routine waits for a "header" from the EAR socket before starting.

If T is selected, you are asked whether you want to SAVE a program (1), variables (2) or a the current screen (3). Pressing the appropriate number leads to a message Press Key to transmit. That should not be done until a few things have been checked.

The cassette lead then connects the EAR and Signal IN socket on cradle. The person at the other end has set up the program to receive and done the same thing. Both yours and the other person's handsets have been strapped on to the cradles using the Velcro strap provided. Anyone else in the room has to be warned that quiet is required or the data might be corrupted by noise in the room.

Once those have been checked you can press any key. The speaker beneath the mouthpiece of the telephone — the end with the label — tends to emit a certain amount of noise. That is amplified Spectrum noise and should be ignored. It will, however, identify which way up the telephone handset should be. The sound the transmission makes is rather like a Spectrum program — first a short header, then a long series of data, both accompanied by the flashing bands on the border.

Saving a Basic program seems to work well, as does a screen file, but DATA tends to be corrupted and warning messages of BAD DATA and WARNING flashing in red on the bottom line appear. The program allows you to try again by sending the program again without touching the keyboard. Breaking the system on the receiving side may crash the system.

The best way to send variables would seem to be to send the complete program, variables and all. The DATA saving also appears to take much longer than necessary, as it still appears to take a minute or so to send even the shortest single string. There is no way at present to send CODE except as string variable. The variables used by the program are listed in a table at the back of the detailed instructions. The only ones which may be of use to the programmer are two bytes which set the colours for the flashing border and four bytes which set the start and end of the data sent.

They may be POKEd but there is no indication as to how to use them without going through the Program/Data screen routine which presumably will re-set them.

The cradle is not a true modem and so will not allow you to talk to any other user not using the same system. ZX-81 and Spectrum versions are not yet compatible, either. It is, however, a cheap and useful way of sending programs down the line and since the variables are sent automatically, interactive games can be used.

Sending from within a program means that when LOADed successfully the program will auto-run from the next line of the program.

The system can also be put together without connections other than to the EAR socket and with no knowledge of modems.

Telephone time, however, is expensive and the system is still affected by noise from its surroundings and from the telephone line. If you have a constantly noisy line, it is not the system for you.

The system will work with model three Spectrum and Interface One. The code is all that is required and that can easily be SAVEd and LOADed from Microdrive.

Micro-Myte 60 costs £39.60 from Micro-Myte Communications, Polo House, 27 Prince Street, Bristol 1. Tel: 0272-299373.

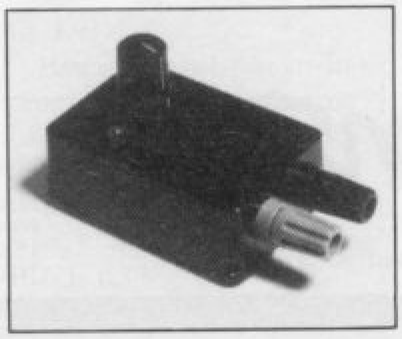
More power to extra keyboards

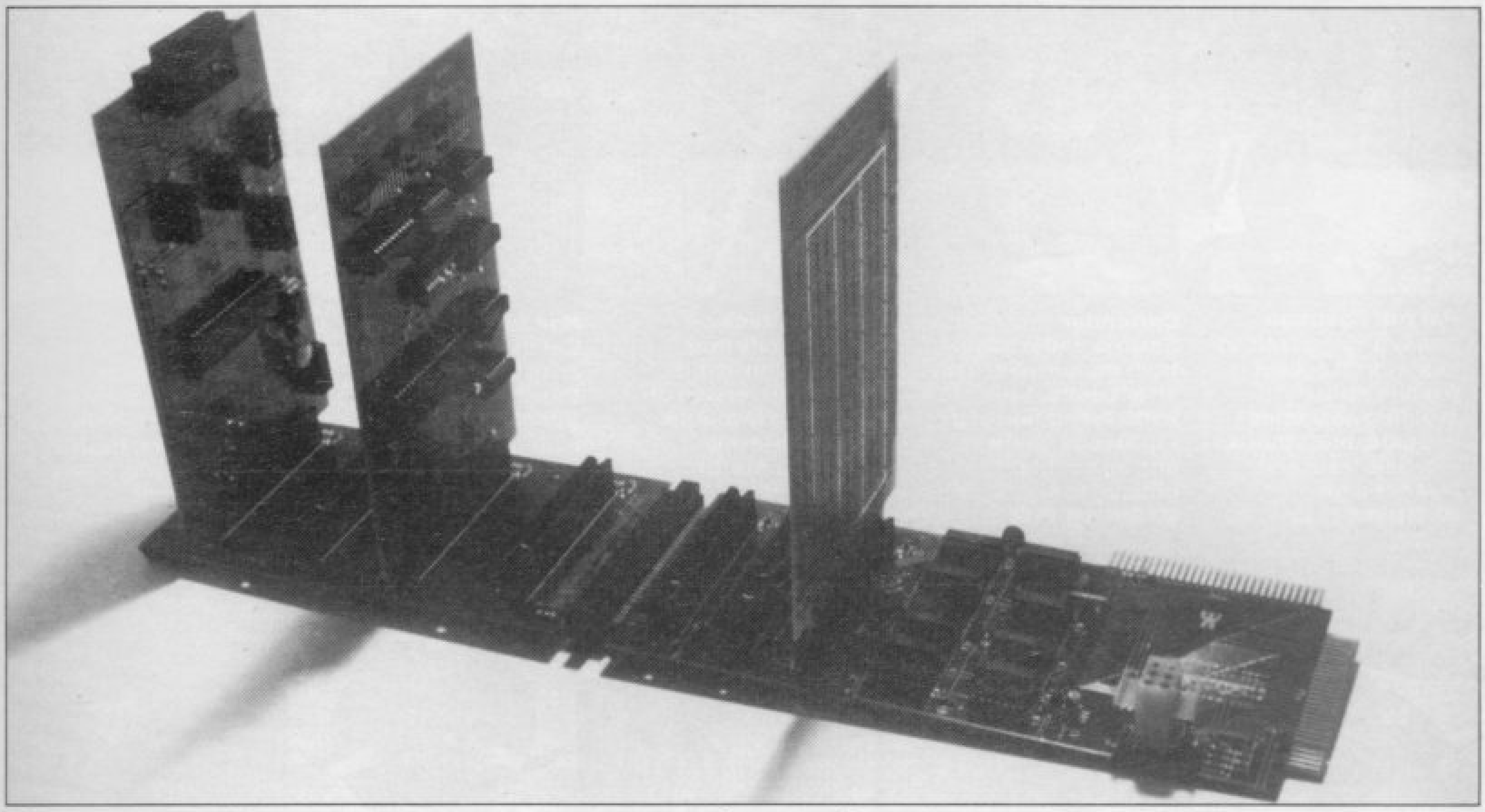
A SIMPLE device is available which allows you to use the ZX-81 or Spectrum +9 volt power supply to power other equipment while you are not using your computer.

Two versions are available, one as a standard +5 volt regulated power supply and the other adjustable from +9 volts to +5 volts. Two screw terminals are provided for the output to your circuits.

It can be used to supply more power to any extra boards on a motherboard system if you have two power supplies. Versions are available for ZX-81 and Spectrum, the only difference being the input power socket.

The unit is in a small, black plastic box $2\frac{1}{4} \times 1\frac{1}{2} \times$ 1in. and has an LED on top to indicate power on. The cost is £6.95 for the non-adjustable version and £7.95 for the variable version. Centec Electronic Systems is at 47 Spur Road, Orpington, Kent BR6 0QR. Tel: 0689-35353.





Card system is ideal for serious work on Spectrum

U - MICROCOMPUTERS, an Apple card manufacturer, has decided to do the same thing for the Spectrum. One of the things for which the Apple computer is famous is the internal motherboard-type slots, which allow you to plug-in things like RS232s, parallel ports and disc drives. All are on separate cards, which need only to be plugged into the system. They are also expensive and some have to be put in particular slots.

The same kind of system has been adopted by U-Micro on its Spectrum range. There is a three-slot motherboard which is completely buffered to reduce the load on the Spectrum. An extension is also offered which will extend it up to seven. That, however, must be supplied by separate power supply using a standard — non-standard to Sinclair users — multi-way plug. The power supply must also supply +12 volts, +9 volts and −12 volts for things like RS232s.

There are, however, advantages. One is that a spare unbuffered printed circuit board edge on the right-hand side of the board is provided; all edge connectors and cards are gold-plated as a matter of course. That can take the Interface One happily and would solve a problem for users whose Spectrum is in a case.

The other advantages are complete Spectrum bus compatability, unlike some other systems, and an alternative decoding system for I/O devices which will allow seven boards to be added to one system without clashes.

That is because the motherboard provides for each edge connector, or slot, to have a different chip-select signal on edge connector position 4A.

That is derived from the top three address lines A7-A5. Internal addresses on each card by U-Micro use the upper three address lines A8-A10.

All that, of course, increases the cost, but U-Micro also compensates for that by detailing in a glossy booklet all the information you want to know about the card you have bought. The booklet contains not only details on how to set up and use the card but also a circuit diagram and specifications of the major chip used.

Listings are also given of any software included in the package. Unfortunately it also includes some mistakes which, although minor, tend to take some gloss from the product. Also for some unknown reason all the booklets have identical covers; it is only when you open them that you can tell which is which.

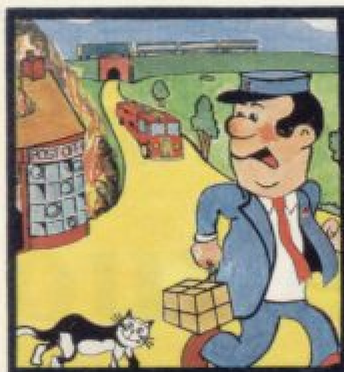
For serious work using a Spectrum the board is ideal; it relieves the Spectrum of power supply problems and loading of the edge connector by too many devices. It also allows you more cards than any other systems which are compatible with Sinclair equipment.

The only problem is that the ideal solution is not inexpensive. An adaptor is required to fit the Spectrum and motherboard printed circuit board edges together costs £6.90, three-slot backplane £35.65, four-slot extension — if required — £25.30. A power supply was not available at the time of writing but a £70 alternative was supplied. The Spectrum one should be half the price, U-Micro says. There should be an additional £1.50 for postage and packing.

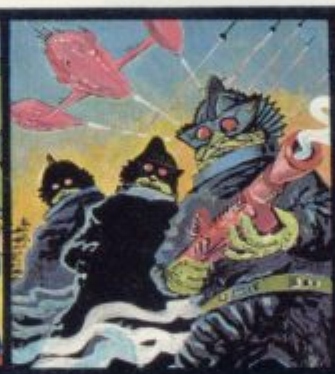
Cards available from U-Micro are dual RS232, dual parallel ports — with a Centronics kit as an extra — and a prototyping card. Other producers' Spectrum cards can also be used but may restrict the use of addresses.

All equipment has a 12-month guarantee and can be obtained from U-Microcomputers Ltd, Winstanley Industrial Estate, Long Lane, Warrington, Cheshire WA2 8PR. Tel: 0925-54117.

More hardware on page 33



Pat the Postman
Really original. All Pat has to do is collect parcels whilst avoiding obstacles – like cars, fires, trains, etc. Skill level and Hall of Fame.
48K Spectrum. £6.95



Deffendar
Earth is under attack from mutant aliens in an accurate implementation of a top arcade game – and one of the most difficult to survive in!
48K Spectrum. £6.95



Cruise Attack
Save the city from annihilation in this wonderful version of an arcade favourite. Nine skill levels, bonus points for attack ships.
48K Spectrum. £6.95



Nanas
Catch the bananas, miss the coconuts. Easy? Try it and see. Simple in concept, hilariously entertaining – it'll drive you bananas.
16K Spectrum. £5.95



Timequest
A warp-space accident spreads your capsule across time. As you land in each new era, fresh perils face you. A very skillful graphic adventure
48K Spectrum. £6.95



One Hundred & Eighty
That famous shout tells you what it's all about! A good implementation of a difficult game – doubles, trebles, twenty-five and bull all possible.
48K Spectrum. £6.95



Land of Sagan
A quest to find the long lost Staff of Health. Is it in one of the castles? Or in the Tower? There are plenty of problems – and plenty of opponents – in this great graphic adventure.
48K Spectrum. £6.95



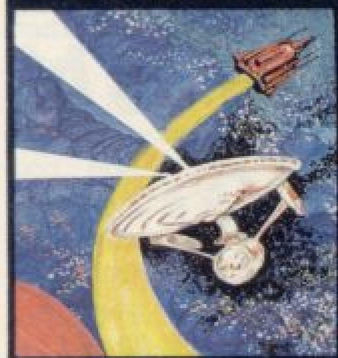
Creepy Crawler
An authentic version of one of the most addictive arcade games devised. All the usual features (Centipede, Spider, Bug, etc) with full use of Spectrum graphics and sound.
16K Spectrum. £5.95



Mad Martha II
Great sequel to the best-selling Mad Martha. Hilarious graphic adventure, with hero Henry in sunny Spain, beset by wacky waiters, mad bulls and the wrathful Martha.
48K Spectrum. £6.95



SAS Assault
Your mission – rescue the Russian ambassador from terrorist kidnappers, before the Kremlin declares war. Loads in two parts – your rating in the second depends on your skill in the first.
48K Spectrum. £6.95



Star Trek
Defend the star systems against the Klingon attack. Runs in real time – so you have to make the right decisions fast!
48K Spectrum. £6.95



Drakmaze
Find your way round Dracula's domain. A game to get your teeth into!
48K Spectrum. £6.95



Laserwarp
Invaders, Aliens, this game has the lot – and you have to survive to destroy the Master! Simple controls, far from simple task.
48K Spectrum. £6.95



Knockout
No aliens, lasers, invaders or rockets – just simple but absorbing fun which up to 4 players can enjoy.
48K Spectrum. £6.95



Galakzions
Watch out as the Galakzions break formation to attack in such force that no mere human can survive!
16K Spectrum £5.95

See them at Lightning, PCS, Tiger, Co-op, Menzies, W H Smith & other leading retailers

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Mikro-Gen, 1 Devonshire Cottages, London Rd, Bracknell RG12 2TQ Tel: 0344 27317

D/A converters incompatible with Microdrive

EPROM SERVICES has produced two digital-to-analogue converters for the ZX-81 and Spectrum. They allow you to program an output voltage up to +9 volts by outputting a number from the computer. One of them is an independent unit which has three A/D converters and requires no extra port to use it. It is a bare board and an edge connector must be soldered on if you are not using a motherboard. The unit is incompatible with the Interface One, which controls the Microdrive, as both use the same address line A4.

The three outputs appear on screw terminals at the top of the board and there are three sets of variable resistors to adjust the zero volts and the maximum volts setting.

Each output is controlled by an A/D converter chip so that all the programmer has to do is OUT a number to set up the system — the port used is based on a 8255 chip — select the output required and output the number for the voltage required.

The device is one of the few which will allow you to obtain more than 2.55 volts DC. The devices can be very useful for measuring where a standard voltage is input and the output is measured by a D/A converter for the device reaction, transistor testing and resistance measurements.

The other D/A is very similar but will fit only on to the Mk 1 version of the company's I/O port.

Both work well but are incompatible with other devices you may want to use on the system.

The three-output D/A board costs £27 and the single output one for use with a Mk1 port only £10.

Eprom Services is at 3 Wedgewood Drive, Leeds LS8 1EF. Tel: 0532-667183.

Useful keyboard spoiled by poor design

D'KTRONICS new keyboard for the Spectrum provides an ABS plastic case which contains the computer as well as providing a 40-key keyboard and a numeric pad. The keyboard keys are a dull grey with clear plastic, stick-on transfers. The numeric keypad is numbered from 9 down to 0, at the bottom, in a 3 by 4 high matrix, the other two keys being CAPS SHIFT and SYMBOL SHIFT. Those being next to each other means that a single finger can be used to get into "E" mode.

The tops are dished and have a solid feel to them, even if they are noisy to use. The plastic transfers, however, tend to wear out after long use. The shift keys are usually the first to suffer. Also red symbols on grey keys do not show very clearly, as Sinclair soon discovered.

The computer is easy enough to fit inside the case; you unscrew the case and remove the printed circuit board, re-screwing it on some pillars inside the case using the same screws. The keyboard connectors are two plugs which go into the keyboard sockets very easily.

An area with posts is set aside for the power-pack board, which also must be removed from its case. The instructions then say a bolt or two must be used to hold it in place. No bolts or holes in the case are provided and no safe position on the printed circuit board exists for bolts. Either the company should drop that as a facility or provide some better method of securing the power supply before someone does some damage.

There is a simple solution. Four upright projections are moulded into the case which go through holes in the printed circuit board. If several turns of insulating tape are wound over those poles — the number of turns can be found by experiment — when the power supply is pushed down over the poles the insulating tape compresses into tight washers above and below the board, holding it into position.

All the wiring should be kept neat and away from the computer board, though the +9 volt plug will have to be taken outside the case to plug into the socket on the computer. Holes are provided in the back for the TV socket, tape sockets, power socket and expansion connector.

One problem with the last item is that some add-ons will not fit, due to the slope on the back of the keyboard case. That means that some items which plugged into the edge connector have their cases stopped about ¼in. away from where they should be, by the edge of the case.

That means that the edge connector does not connect with the device. It should be corrected immediately. It can be solved by cutting away the projection under the expansion port for at least the whole length of the edge connector. Microdrives and Interface One cannot be connected to a Spectrum in this type of case without a massive cutting-out of the back of the case.

It is a pity that the keyboard and case is spoiled by moderate design. A little more thought about adding things to the Spectrum would have made a much better product.

D'KTronics is at Unit 2, Shire Hill Industrial Estate, Saffron Waldron, Essex CB11 3AX. Tel: 0799-23650/22359. The cost of the keyboard is £46.25.

Timely for experiments

GLANMIRE Electronics of the Republic of Ireland has produced a real-time clock and eight-bit I/O port for the Spectrum or ZX-81. The crystal-controlled clock is battery-driven and is re-charged when connected to the computer power supply — a maximum of 40ma according to the booklet.

It is set to compensate for various months but not leap years. It can be adjusted by a screwdriver control on the board to go faster or slower. A 256-byte PROM mounted on the board provides the software to read and write to the clock from within Basic and the time is returned in a Basic variable called T$

It provides a good basis for experimenting but at a cost. It is also incompatible with most other I/O equipment for the Spectrum, as it uses all the spare addresses. The board provides a full ZX-81-type extension at the back for a RAM pack. It might be useful with some applications which require an accurate, independent clock as part of time-keeping systems, such as accounts control or data logging.

From Glanmire Electronics Ltd, Meenane, Watergrasshill, Co. Cork, Ireland, the clock and I/O ports costs £40 for the Spectrum version and for the ZX-81 version £36. They are not interchangeable.

fantasy SOFTWARE

THE PYRAMID is an arcade style game which has a very adventurous feel to it.

The Pyramid contains 120 chambers on 15 levels. In order to get from one chamber to another you must fight off the indigenous aliens to collect an energised crystal which will neutralize the force field guarding the two exits.

The Pyramid is inhabited by a total of 60 wierd and exotic alien types, all of which are beautifully animated. You will meet a whole variety of demons, droids, insects and monsters, with a sprinkling of the more unusual, the extra-terrestrial tweezers, galactic strawberry, cosmic claw, mutant eye, plus a whole host of entities that defy rational description. You will no doubt invent your own nicknames.

You proceed to explore the Pyramid from top to bottom with the difficulty generally increasing with the depth of level. Depending on the choice of exit from each chamber you are likely to have a different game every time you play.

Apart from the challenge of trying to achieve the highest score possible the pyramid contains a number puzzle to solve. The more chambers you successfully visit the more information is gathered to enable you to discover the secret numbers of the pyramid. The puzzle won't take you a few days to solve, it will probably take you a few months.



This is "ZIGGY". He is shown above in his exploratory capsule and is a true representation of the on screen graphics. You have total control over his movements as you explore the many chambers of "THE PYRAMID".

FANTASY SOFTWARE is available from W.H.Smiths, John Menzies and Computers For All

Compatible with all leading joysticks.

THE PYRAMID

For 48K Spectrum

THE PYRAMID is available at £5.50 from
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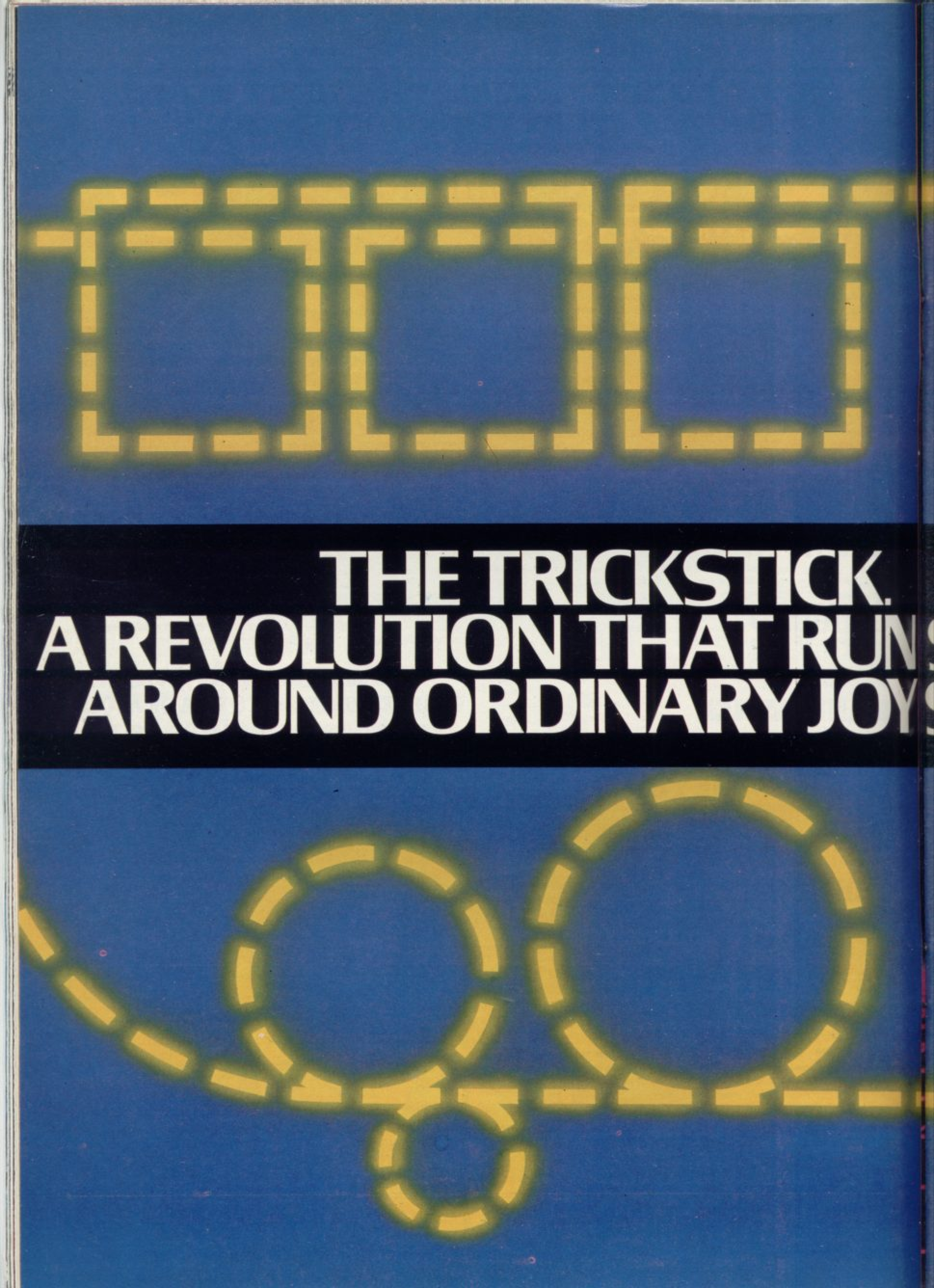
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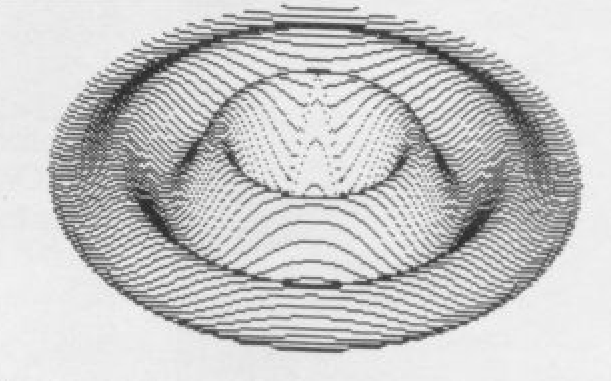
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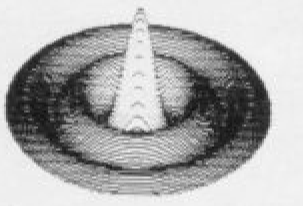
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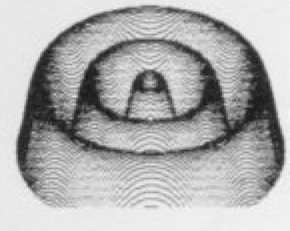
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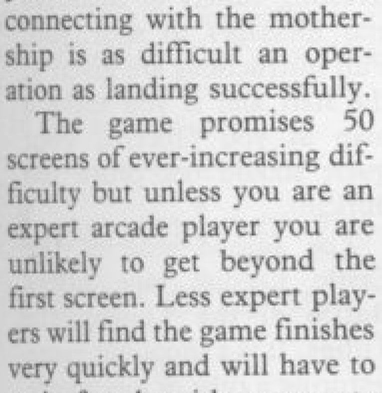
Few rewards in difficult mission

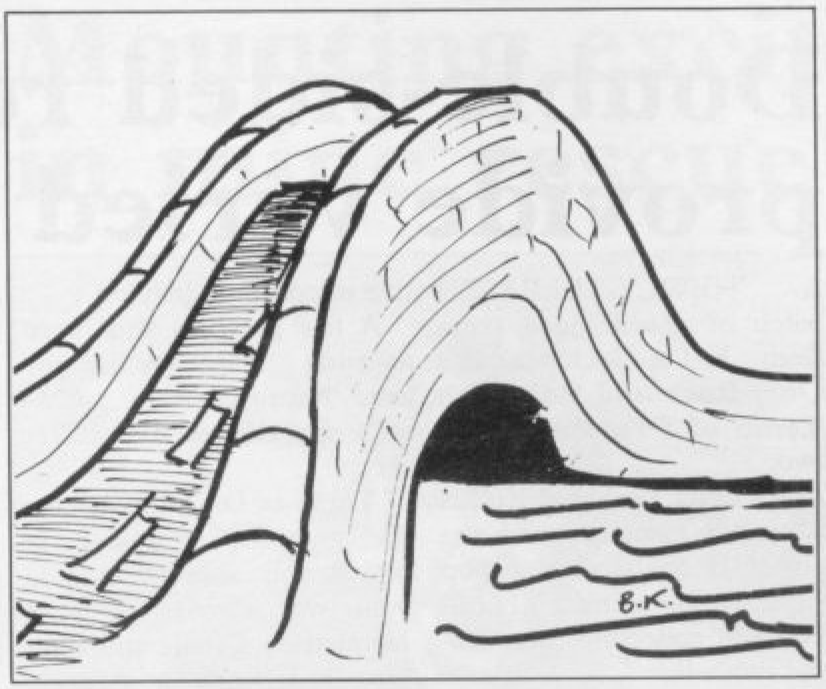
SILVERSOFT is not exaggerating very much when it calls one of its new releases **Mission Impossible.** Something like a cross between Frogger and Lunar Landing, the game features a space vessel which has been sent to rescue a group of astro-miners trapped on Titan.

As it descends from the mothership, the vessel has to avoid a barrage of meteors, any of which will destroy it, and it has to drop squarely on a landing pad if it is not to crash. On the way up, a host of alien spacecraft bar your way but you can blast them with your laser, scoring points each time. Finally, connecting with the mothership is as difficult an operation as landing successfully.

The game promises 50 screens of ever-increasing difficulty but unless you are an expert arcade player you are unlikely to get beyond the first screen. Less expert players will find the game finishes very quickly and will have to wait for the title screen to appear and clear again before starting another game, which could prove discouraging.

The graphics are simple and it seems likely that only those with a taste for difficulty will find this a rewarding exercise. Mission Impossible is obtainable from Silversoft, London House, 271/273 King Street, London W6, and costs £5.95.





Plumbing depths of a testing puzzle

ABYSS for the 48K Spectrum is a simple graphics adventure which is designed to test your refelexes as well as your mathematics. The idea is that you must cross a series of rickety wooden bridges over an **Abyss** surrounded by monsters which lurk in the shadows.

Each time you cross a bridge you are presented with a challenge which you must overcome before proceeding to the next bridge.

The test might be negotiating a maze using a complicated set of keys, avoiding giant rats, recognising a word in a split second, or doing some mental arithmetic before your time runs out. The sequence of the tests changes constantly and you need to be able to think quickly. If you play the game a few times, the answers will be increasingly easy to find, so it does not offer endless scope.

Nevertheless, it is a lively puzzle, with amusing responses from the computer, although in one case we suspected that it threw us into the abyss in spite of a correct answer.

Abyss is available from Cases Computer Simulations, 14 Langton Way, London SE3 7TL. It costs £5.

Slow vampire pursuit discourages interest

TERMINAL SOFTWARE calls it **Vampire Village,** a real-time graphic adventure. The scenario is that you are the mayor of Vladsdorf who has heard that a vampire threatens outlying farmsteads.

You start with a fund of £999 with which to hire villagers to help you locate the vampire and you must direct them in their search.

A map shows the village and the river which runs beside it and you can move each volunteer by using the cursor keys.

Pressing V will give you the words you can use and pressing P will show the player's position at any stage.

Unfortunately, the graphics are painfully slow and obtaining any meaningful response from any of the vocabulary keys is in most cases unrewarding, so that it is easy to lose interest in the fate of the trusty villagers before you get anywhere near the vampire.

Vampire Village can be obtained from Terminal Software, 28 Church Lane, Prestwich, Manchester M25 5AJ. The cost is £6.95.

Gambling without cash

TEMPTATION Software brings the bright lights of Las Vegas a little closer to home with two games on one cassette for the 16K Spectrum. **Fruit Machine** is a faithful replica of the familiar pub game, complete with spinning symbols and nudge, hold and cancel keys. You can collect or gamble and your score is laid out neatly at the side of the screen. Fruit Machine cannot claim originality, nor does it offer the thrills of gambling for money, but the graphics are excellent and, within its limits, the game is presented professionally.

Black Jack on the same tape is a version of the card game, Pontoon. You start with £10 and lose or win 10 pence at each tussle with the computer. True to the rules of any gambling den, the computer as the banker has the edge over the other player in case of a draw and you will probably see your winnings decrease steadily.

If you win a hand, you can choose to collect or try to double your stake. Black Jack does not hold the excitement of a genuine card game played for cash but the responses are fast and the challenge of trying to beat the computer is addictive.

The cassette insert explains the rules of both games clearly. **Las Vegas** is available from Temptation Software, 27 Cinque Ports Street, Rye, Sussex.

More software on page 40

Fast action for trapped tarantula

BILLED as "the bugs bite back", the Work Force **Doom Bugs** for the 16K Spectrum promises you a busy time. The player takes the role of a tarantula trapped inside a grubber's lair. The way out is via a trapdoor at the centre of the screen and you must try to bore your way through it with the help of a nibble of honey to renew your strength at each attempt.

Meanwhile, the grubbers are reproducing at an alarming rate. When two eggs meet, a green bubbergrubber is hatched and if two green bubbergrubbers meet, they form a red grubber which will destroy you if you collide with it.

What with locating the centre of the trapdoor, nipping back for some honey, and trying to destroy eggs and grubbers before they team up to destroy you, escaping is an exacting task. The placing of the keys, which you cannot re-define, does not make things easier.

The graphics and sound are suitably frenetic and the action is fast enough to satisfy the most practised of arcade addicts. You receive points for eating grubs and a bonus for fighting through to the next level where the scene is a maze and the action even hotter than before.

Doom Bugs can be obtained from Work Force, 140 Wilsden Avenue, Luton, Beds. It costs £5.50.



Double-sided releases provide varied choice

A NEWLY-RELEASED batch of double-sided tapes from K-Tel includes **It's Only Rock and Roll,** with **Tomb of Dracula** on side two.

It's Only Rock and Roll is a strategy game in which the object is to become a pop superstar by earning £1 million and collecting three status symbols.

Among the options are choosing a name for the group, planning tours, hiring managers and selecting songs. Time, money and energy are your resources and you lose the game if you run out of any of them.

The odds are stacked heavily against you and neither the songs which the computer offers for your approval, nor the occasional news flashes which are intended to enliven the game — "Government taxes pop groups" or "Tony Blackburn likes Sinclair Swingers", for example — provide much of an incentive to continue playing.

A few graphics and more amusing responses might have improved this potentially appealing idea considerably.

Tomb of Dracula is a simple graphics adventure in which you attempt to find your way through a tomb haunted by ghouls and zombies and reach a staircase leading to Dracula's treasure. On your way, you must collect silver stakes with which to defend yourself and be careful to avoid the slime pit. You may find yourself repeatedly entering empty vaults and neither the story line nor the graphics is original enough to compensate.

Castle Colditz, on another double tape, is a slightly more sophisticated adventure, in spite of the fact that it has no graphics.

The location is the notorious prison fortress, from which you are trying to escape while collecting as much



Nazi loot as you can to take with you.

lecting as much Nazi loot as you can to take with you.

The scene changes quickly — from bath-house to trophy room to mortuary among others — and there is an interesting variety of treasures and messages to spur you. Full instructions are given at the start and if you make a map as you proceed, your quest should not prove too difficult.

The second side of the Castle Colditz tape offers **Battle of the Toothpaste Tubes.** It is a shoot-out game featuring a tube of toothpaste from which you fire at the evil brush brigade and the serried ranks of mini-tubes below.

You must beware of the chattering teeth but can protect yourself with your fluoride shield. If you hit the handle of a brush instead of the bristles, your toothpaste will rebound.

Apart from the novel scenario there is nothing particularly original about a simple arcade game which should only please anyone who is addicted to pressing the fire button.

It's Only Rock and Roll and Castle Colditz are available from K-Tel International, K-Tel House, 620 Western Avenue, London W3 0TU. The cost is £6.95 per double-sided tape.

Detective story will leave you guessing

IN THE **Detective** for the 48K Spectrum, you must imagine you are a private eye who is trying to get through Dagger Alley to steal secrets from a mysterious safe. The game has 25 levels and if you reach the final level, which the insert warns is unlikely, you have 10 guesses at the combination of the safe.

The game starts with the detective being pelted by unexplained objects which could be bells or possible cups; you score points by shooting at them but are threatened with extinction by old car tyres which gather together and drop on you if you do not move out of the way. The detective moves left and right along the bottom of the screen and if he disappears off one side he will reappear from the other.

The action is fast and even the first level is difficult but there is no explanation, either on the tape or on the cassette insert, as to what is happening, which detracts considerably from the interest of the game. Unless you are already firmly addicted to zapping anything in sight, this is unlikely to convert you. The Detective is produced by Arcade Software, Technology House, 32 Chislehurst Road, Orpington, Kent BR6 0DG. It costs £5.50.

Less software production for ZX-81

WE NOTE with regret that software manufacturers appear to be winding-down their production of tapes for the ZX-81 The absence of ZX-81 reviews in this issue of *Sinclair User* reflects the scarcity of programs for that machine and not lack of interest on our part.

The ZX-81 still serves as an excellent and very popular introduction to computing and it continues to sell well both in the U.K. and overseas. It would be a pity if software houses were to ignore a substantial market of new users whose enthusiasm might well be reduced by a limited supply of programs.

We hope manufacturers will realise the importance of the ZX-81 and that we will be able to provide more reviews in our next issue.

Learning to play chess

IF YOU would like to learn to play chess, the Artic Computing **Chess Tutor** for the 16K Spectrum is a good way to start. The program starts with a visual display of the ways in which each of the chess pieces can move — only the Knight's move is a little difficult to follow. It then explains the rules and aims of the game and finally allows you to choose whether to play against the computer or to let the computer demonstrate a game based on your opening move. If you decide to play, you can choose from three levels of difficulty and the computer will display the book opening it has used at the side of the screen.

Chess Tutor is available from Artic Computing, Main Street, Brandesburton, Driffied YO25 8RG. The cost is £6.95.

Mounting excitement in mine rescue



IT IS difficult to see why Visions set its **Pitman Seven,** an arcade game for the 48K Spectrum, in a South African mine, as that can scarcely count as a major selling point.

Pitman Seven promises plenty of action and excitement. Two teams of seven men are trapped underground and your job is to bring each one to the surface, despite a series of falling rocks which pursue the men along the shafts. You can climb ladders or drop through trapdoors and if you are lucky you might even be able to avoid the boulders by jumping over them.

If you manage to get your men to the top and to safety, you go to the next level, where waves of gas create an additional hazard.

The object is to collect a series of strategically-placed suits to protect yourself as you try to escape.

The concept of the game is yet another variation on the maze-with-hazards theme but the pace of the action is well-judged and the graphics are very professional.

The computer also offers some hard-hitting comments about your performance at the end of each mission.

Pitman Seven is available from Visions Software Factory, 1 Felgate Mews, Studland Street, London W6 9JT and costs £6.95.

More software on page 42

Weight controller

"NOW your computer can look after you instead of defending the earth," says the introduction to **Diet Master,** which aims to help you control your weight and plan a healthy diet on the 48K Spectrum.

The program is accompanied by a booklet containing the information about calories and the nutritional value of various foods and as you are asked questions about your age, size, build and activities, you are referred constantly to the book for background information.

The authors claim that Diet Master can provide a personalised diet plan faster than books could do but that is debatable. There are any number of books and charts covering the same material and it should be possible to plan a sensible diet for oneself by using them. But if you like to let the computer do the work for you, this is a clearly-explained and well-presented program.

Diet Master is available from Delta 7 Software, 11 Claremont Drive, Headingly, Leeds LS6 4ED.

Ladders unsafe in duck game

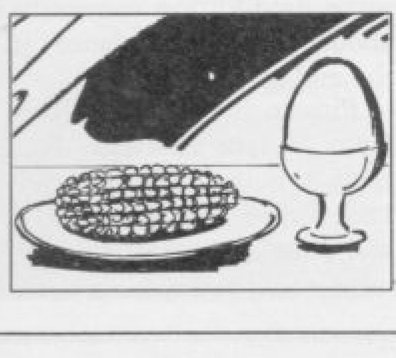
CHUCKIE EGG for the 48K Spectrum presents yet another variation on the Donkey Kong theme. Here the object is to negotiate a system of platforms and ladders, picking up eggs and corn on each level while pursued by giant ducks.

It is surprising that the ducks give you less concern than the ladders. Whether intentionally or not, the game makes it difficult to get on or off the ladders unless you are in the proper position. The slightest touch on the key might make you over-shoot your target and, as the ducks approach, you will find yourself unable to move out of the way.

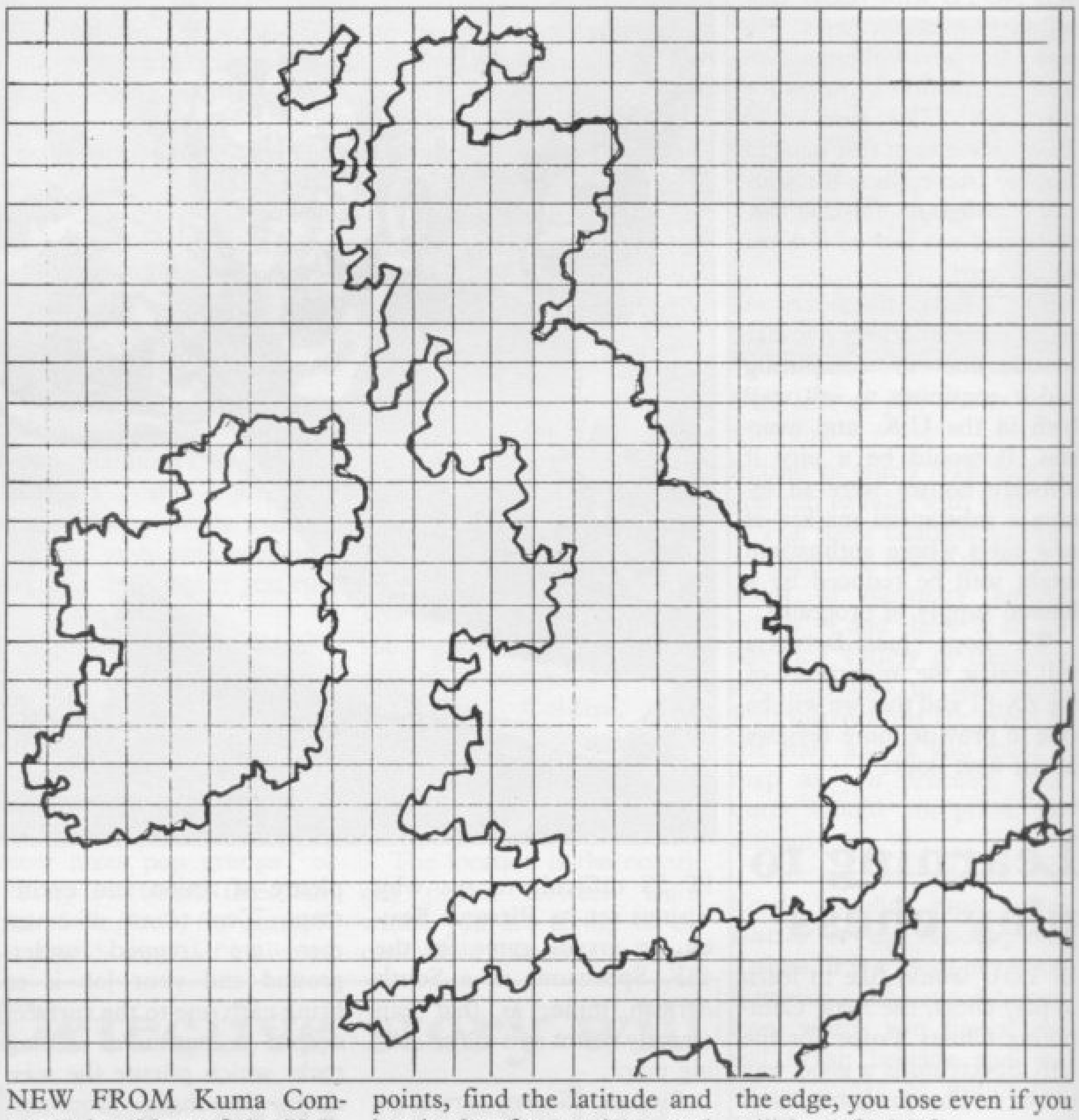
The game also offers a jump facility but judging your leaps accurately is no easier than climbing the ladders. Nor is it any use thinking you can wait for the ducks to cruise past you because you are playing against the clock and might run out of time.

Each level presents new challenges, such as bigger gaps in the platforms on level two, and moving lifts on which you must try to jump on level three. Fortunately you have three lives on each level, which obviates the need to return to the beginning again each time you are mauled by a duck.

Even though the difficulty of using the ladders as an escape route slows the game considerably, **Chuckie Egg** manages to be highly addictive and has appealing graphics and sound. It is produced by A & F Software, 830 Hyde Road, Gorton, Manchester M18 7JD, and costs £6.90.



Getting the general drift of the map of the U.K.



NEW FROM Kuma Computers is a **Map of the U.K.** program for the Spectrum. It allows you to see a 75-mile by 60-mile area of anywhere in the U.K. and the Republic of Ireland and extends also to Calais.

The map shows only the coastal outline and as many towns and cities as Kuma could fit. The 75-by-60-mile window can be scrolled in all four directions in fine, medium or coarse steps.

When you reach the edge of the map, the program beeps and will not let you go further.

Besides being able to scroll the window, you can also search for a named town, find the distance between two points, find the latitude and longitude of any place, and copy the screen to the printer.

Everything you need to know about operating the program is contained in instruction screens. Typing 'H' always returns you to the Help page, which displays all the command instructions. Only valid commands are accepted and the program ignores all other key presses except BREAK. CONTINUE re-starts the program.

Also included is a balloon game in which you burn a limited amount of fuel to try and keep a balloon aloft as long as possible while you drift seemingly at random over the map. If you drift off the edge, you lose even if you still have fuel left.

The only problem encountered with the program is that nowhere did it indicate whether it was for a 16K or 48K Spectrum and there was no mention of the name Map of the U.K.

The program is about 17½K and the data is about 22½K of code so it takes a long time to load from tape. While a map program is certain not to be as exciting as a game, this is a very user-friendly program with no obvious bugs.

Map of the U.K. is available from Kuma Computers, 11 York Road, Maidenhead, Berkshire. It costs £11.95.

Take-over strategy for city

ANOTHER RECENT offering from CCS is **Gangsters,** a strategy game for the 48K Spectrum. As the leader of a gang in the U.S. in the prohibition era, your objective is to take over a city from other gang leaders. You start with a certain amount of money and a certain number of gangsters, and can invest in assets such as speakeasies, distilleries and casinos.

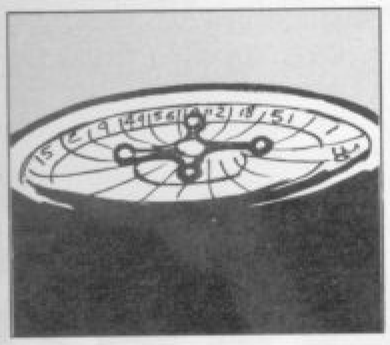
You can also use your funds for your personal protection and the bribery of city officials and must cope as best you can with unforeseen events, such as raids from rival gangs or being arrested.

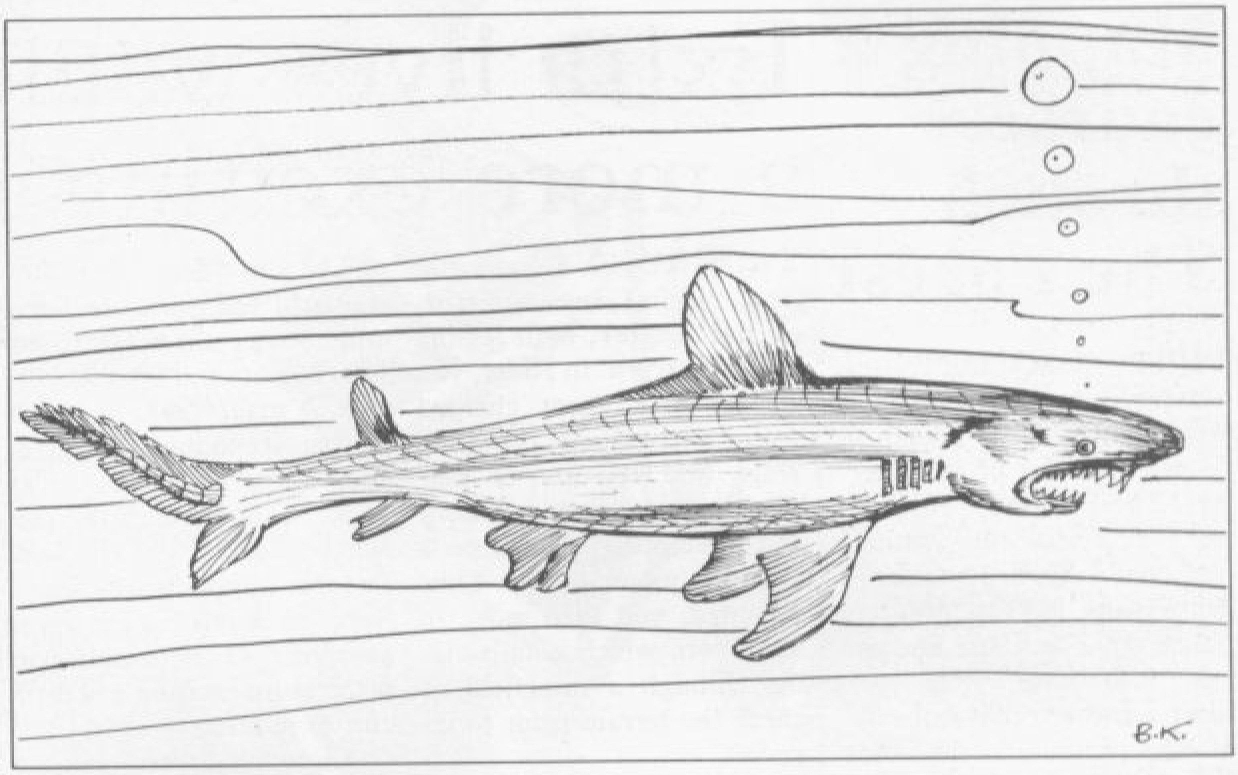
It is even possible to go into murder mode and hire a killer to wipe out your rivals and a sub-plot concerning the search for the other hidden arms of the gangs is an appealing twist to the story.

At the end of a round, your monthly position is shown and you go on to the next month's tribulations, attempting to move up the player league table by increasing your income.

Gangsters is very similar to a board game, with the computer throwing the dice and keeping track of assets, gang members killed, and so on. The graphics are simple but the game is carefully-presented and there is plenty of variety to keep you playing. You can also choose from nine levels of difficulty.

Gangsters is available from Cases Computer Simulations, 14 Langton Way, London SE3 7TL, and costs £6.





Underwater challenge

AQUARIUS for the 16K Spectrum will remind any aspiring James Bond just how perilous life can be under water. You have to imagine that you are the commander of a frogman team whose mission is to destroy the death machines an enemy government has built in an underwater cavern.

At the beginning of the game you are given a secret colour code to remember, your eventual aim being to shoot at the colours in the correct sequence to wipe out the enemy lair.

You may find, however, that proceeding that far is an impossible task. You will be pursued by jellyfish, poisonous sea squirts and sharks, and if none of those gets you, you can be blown up by mines or entangled in deadly weeds at the bottom. You can shoot your way out of trouble, scoring points as you do so, but remember that the shark, which even after you have avoided it advances towards you from the other side, must be shot square in the head. To add to your troubles, you must remember to pick up oxygen tanks on your way or you will die from lack of air.

If you manage to survive the first set of hazards, level two offers a jagged cave to swim through, with an electric barrier at the end of it.

The number and awkward placing of the keys needed to play **Aquarius** present an additional challenge and you may find it easier to succeed in your mission if you use a joystick.

Aquarius is available from Bug-Byte, Mulberry House, Canning Place, Liverpool L1 8JB and costs £5.95.

More Software on page 44

Battle of the mental blocks

MANOR SOFTWARE calls its **Scatterbrain** for the 48K Spectrum a game of logic and deduction. The basic idea is that your brain contains a number of mental blocks which prevent you thinking straight. The first stage in eliminating the mental blocks is to launch mind probes to find them and the second stage is to fire surgical lasers to destroy them.

Locating the blocks is made more difficult by the fact that if your probe gets near them, it will go in an unexpected direction; if it hits one, the probe will disappear. Eventually, you deduce the position of the blocks from the behaviour of the probes.

The brain and its mental blocks are represented by a grid which looks very much like the old pencil and paper game of Battleships. You launch your probe by inputting the numbers of the side and column in which you think the block might be.

If you lose patience with elaborate instructions and a complex set of rules, the game is not for you. It starts with a seemingly endless succession of screens giving information which you must absorb fully to be able to play the game. If you are persistent and like a taxing puzzle, it should provide an absorbing occupation. It is for one or two people and there are nine levels.

Scatterbrain is produced by Manor Software, 24 Manor Gardens, London SW20 9AB. It costs £5.95.

Mapping a course through The Forest

PHIPPS ASSOCIATES has produced a simulation program for the 48K Spectrum to teach the art of orienteering. **The Forest** is presented very professionally, with a map and a detailed booklet to accompany it. The program offers a pre-set route but you can also map your own course and use that instead.

The program is definitely not for novices. The booklet warns that you need a ruler graduated in millimetres and a protractor for measuring angles to participate; the graphics change to show your position as you move, taking into account the contours of the terrain and variations in bearing and length of step.

You use the cursor keys to move. The left and right arrows move you 11.25 degrees each time, the up arrow moves you forward for as long as you keep it depressed, the down arrow turns you 180 degrees to face the way you have come. Other commands allow you to check your bearings, see your control card, enter your code and check your time.

Unless you are an experienced orienteer, it is very easy to get lost and the booklet recommends you to keep track of all your moves as you make them.

Even experienced orienteers will probably be relieved to know that it is necessary only to arrive within five metres of the finish point marked on the map.

The graphics are simple but effective and the booklet provides very thorough explanations. The Forest is available from Phipps Associates, 172 Kingston Road, Ewell, Surrey KT10 0SD. The complete package costs £9.95.

Extra lives would make a more exciting ride

TWO RECENT releases from Virgin Games are **Rider** and **Angler,** both for the 48K Spectrum. In Rider, you are an MI5 agent charged with a two-part mission. Stage one consists of parachuting into enemy territory and attempting to land on a moving motor-cycle. Thus mounted, you then move to stage two, which entails riding through a minefield to check the terrain prior to invasion.

You choose any level of difficulty from 001 to 007 and must avoid not only randomly-placed mines but obstacles which may cause you to crash. If you manage to stay the course you will be promoted.

The graphics in both stages of the game are lively and the second stage promises a fast and challenging ride. A major fault, however, is that if you crash during stage two, you have to go back to your original parachuting exercise. Extra lives for the motor-cyclist would have made the game more satisfying, as the second part is the more exciting and difficult to master.

Angler could help confirm the low status of fishing as a spectator sport. In it you are at sea with your trawler, attempting to catch a variety of fish, all gaining different scores according to their type.

The trawler moves left and right and pressing any key casts the fishing line. According to the instructions, the length of time you keep the keys depressed determines the length of the line but, in the reviewer's experience, the line showed an infuriating tendency to stop short of any fish at which it was aimed.

The game features a scoreboard so that you can compete against your friends and a high score earns a certificate of merit. Fairly rudimentary graphics and slow responses, even if you choose an advanced level of difficulty, do not make it wildly exciting.

Rider and Angler are produced by Virgin Games, 61-63 Portobello Road, London W11 and cost £5.50 each.

Sailing for profit on the high seas

IN CARIBBEAN Trader for the 48K Spectrum, you are the captain of a cargo vessel plying the Caribbean. Starting with your funds and a loan from the loan shark, your aim is to invest in various cargos such as tobacco, guns, spices and slaves and see if you can make a killing in any of four island ports.

Each time you set sail, a variety of things can happen to you — rebel pirates might board you and buy your guns, a police party might confiscate your illegal cargo, or a typhoon might force you to jettison everything on board. On the other hand, it might pass over without causing any serious damage.

Meanwhile, the prices of the commodities in which you are interested are fluctuating and the interest on your loan continues to rise. The game can be played on three levels of difficulty and in spite of very basic graphics, the lively story-line and a number of possible variations — many depending on the route you happened to be sailing — make it an addictive strategy game. Meeting the objective — becoming solvent — is not easy, which adds further interest.

Caribbean Trader is available from East Midland Software, 54 Ryecroft Street, Stapleford, Notts, and costs £4.95.

Difficult to run rings round it

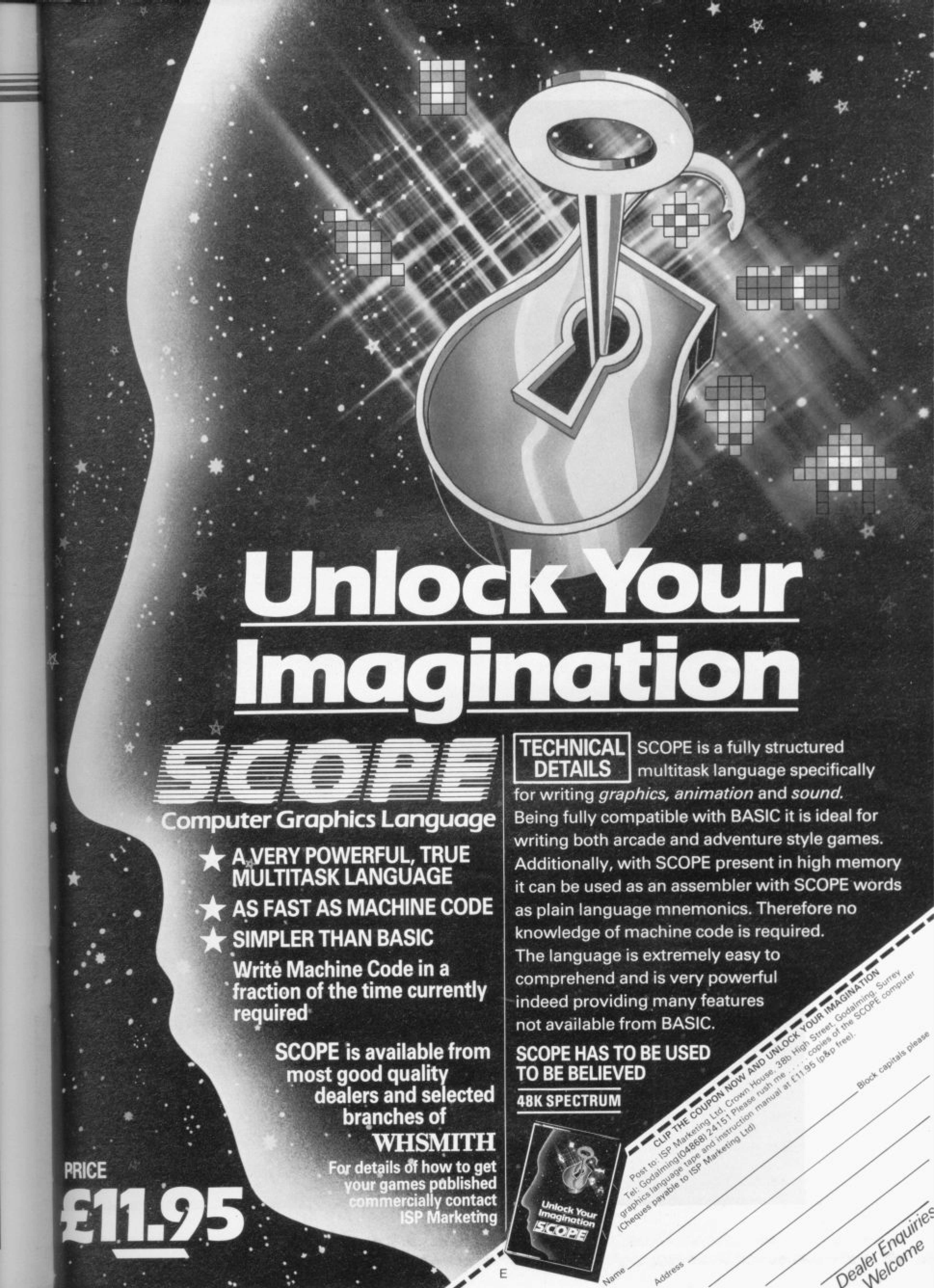
BILLED as "an inscrutable puzzle," **Hanoi King** for the 16K Spectrum is another version of that ancient game, Towers of Hanoi. You have three pillars, with anything from three to nine rings on the first. The object is to transfer the rings from the first to the last pillar in the minimum number of moves, remembering that a large ring cannot go on top of a small one.

The puzzle is easy when playing with three rings, much more difficult with nine, when 511 moves are needed to succeed. An 'L' option allows you to see a demonstration by the computer of how it is done.

The graphic representation of the game is very simple and there is no indication of how many moves are needed on the lower levels, something you have to discover yourself.

It is such a classic puzzle that it cannot fail to absorb you but more could have been made of it with better graphics and perhaps a more interesting scoring system.

Hanoi King is available from Contrast Software, Farnham Road, West Liss, Hampshire GU33 6JU. It costs £4.95.

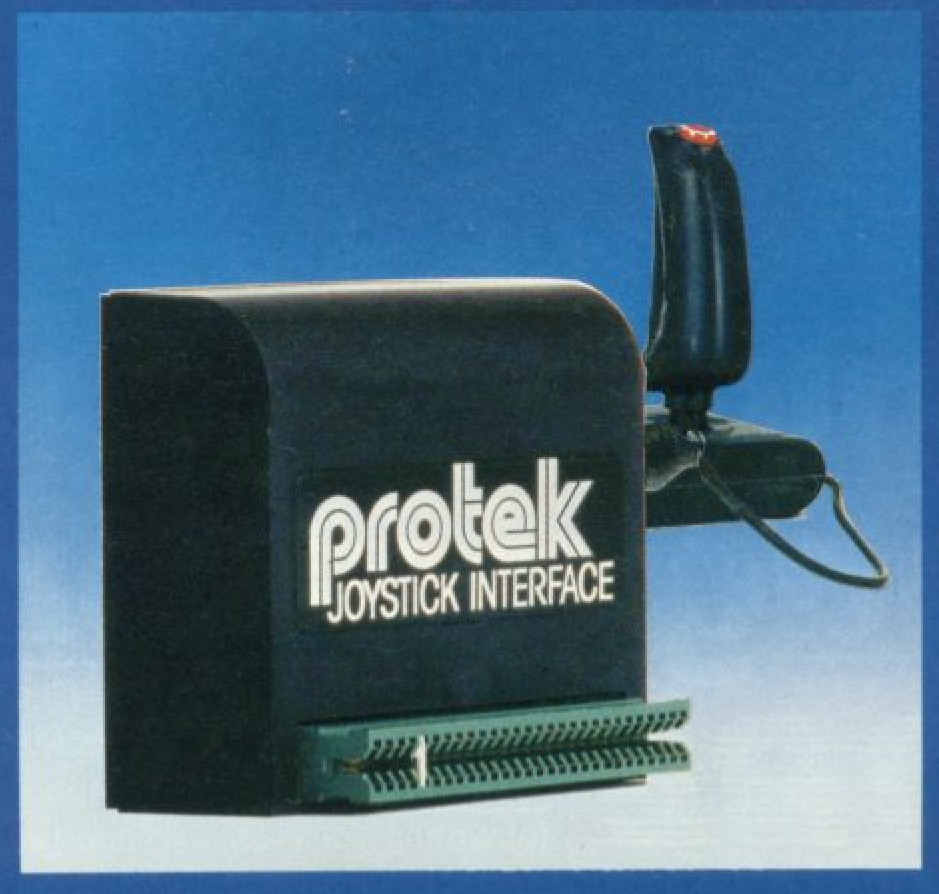


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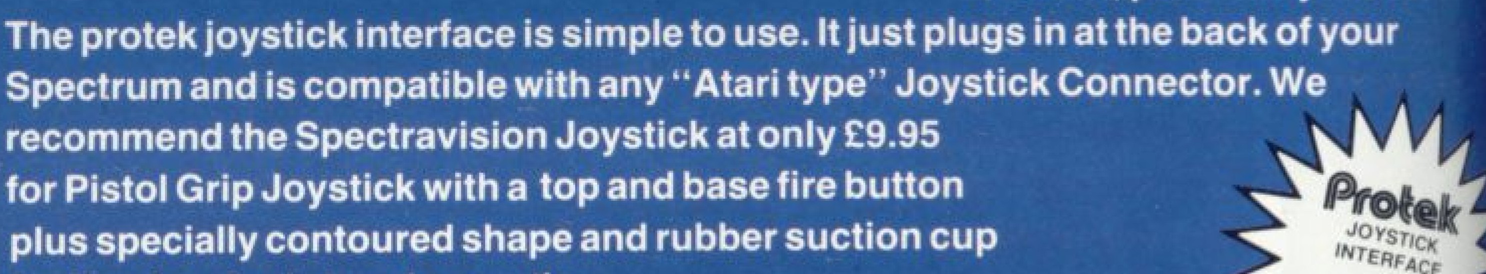


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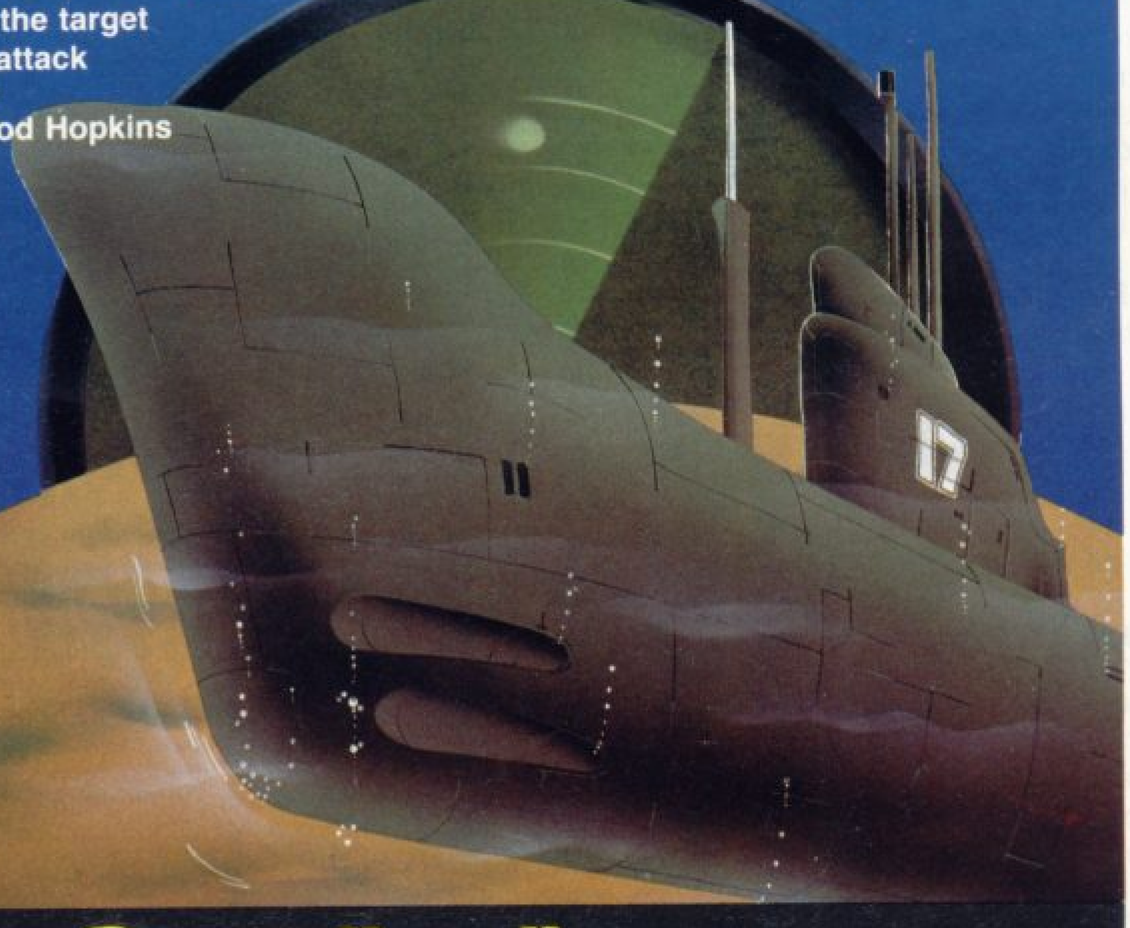
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Keyboard replacement eases the way to a faster game

John Gilbert looks at the differences which using a joystick can make to some well-known programs

THE MOST OBVIOUS aspect of joystick games and interfaces is the incompatibility in the market. That was not helped by the introduction of another standard when the Sinclair Interface Two reached the market. The only real compatibility of the device with the rest of the software available is its incompatibility.

Interface Two and the promised Sinclair joysticks, advertised but which few people have seen, use the cursor keys. Sinclair Research does not seem to have realised that most of software produced for the Spectrum uses anything but those keys.

The good news so far as the Interface is concerned is that Sinclair has made sure that most of the games are in its cassette and EPROM library. The games which are available so far on EPROM—not ROM—are few and all of them are old favourites. Sinclair has launched two games which are new to the library, the Ultimate range, including **Cookie PSSST** and **Jet Pac.**

Jet Pac is an excellent example of how the Interface works with the software. The game entails donning a space suit and jumping fom planet to planet in search of treasure. That sounds easy but on each planet there are various types of alien to fight with your laser gun. To get off the planet and beat the baddies you must find the various sections of your rocketship and then jump into it. The rocket will then take off with you inside.

The game is simple using the normal key combinations but it is made easier with a joystick. Unfortunately it is made a little too easy with the device.

Since the release of the Ultimate game on cartridge, the original manufacturer has released **Lunar Jetman.** It can be described only as a sequel and it contains many of the elements of Jet Pac with a few more added to make it more entertaining.

All the action takes place on the surface of a planet where the spaceman who is under your control has transport in the form of a lunar buggy. Into it he must pile treasures which can be picked up on the way round the planet. If all the treasure and gadget-hunting was not sufficient you will have to dodge aliens which are depicted in 3D.

The game is almost unplayable if you use the keyboard combination but if you use a programmable joystick with some of the options it becomes bearable. If you become proficient with a joystick you should be able to notch some good scores.

Lunar Jetman is just one of a number of games which are difficult to use because of the keyboard layout and so could benefit with the addition of a joystick. The 3D masterpiece, **3D Tunnel** from New Generation Software, is very difficult to play using the keyboard. That is not because of any difficulty with the way the control keys are laid out but because of the slowness of the response when you press a key to change direction.

The game has the player moving through an underground tunnel in which there are many natural creatures, such as rats, spiders and toads, with an evil-looking subway train at the end. If you hit one of the walls of the tunnel while trying to kill a creature with your laser gun and cannot change direction you will die. If you use a joystick you should be able to change direction easily or, better still, stay in the middle of the tunnel.

With 3D Tunnel the joystick helps only slightly because movement in the game is not particularly easy in any event.

Two other games which benefit from the use of a joystick but can, with practice, be played on a keyboard are from Imagine Software. **ZZoom** has the player in the hot seat of a rocket launcher which must stop aircraft buzzing in the sky which are intent on killing refugees on the ground. The response to the controls is fast but a joystick is needed to take advantage of the speed and also to leave the user free to think about the game and not the keyboard layout.

Zip Zap is the other game from Imagine. It benefits from a joystick option because the central character, the last fighting robot of a long-dead race, has an unusual movement pattern. On the keyboard it is controlled using two keys. If you use the left key it will start to turn anti-clockwise and if the right key is pressed it will start to turn clockwise.

The movement pattern is not easy to assimilate but it is just bearable using the keyboard. Things are made better with a joystick. All you have to do is push the stick left or right and the robot goes in the direction you wish.

The object is to pick up the time keys and reach the time transporter to proceed to the next page of the game. The effects of the joystick are so good that you should find yourself getting on to levels you had thought impossible.

> 'The response to the controls is fast but a joystick is needed to take advantage of the speed and also to leave the user free to think about the game and not the keyboard layout'

Programmble joysticks such as those from AGF Hardware and Cambridge Computing can be used with any game and you should think about the joystick first and not the games with which it is compatible, no matter what the manufacturers would have you believe. In the testing for use on a wide range of games, programmable joysticks were near the top.

The industry standard seems to be the Kempston interface and joystick. It is not programmable in the same way as the definition caters for that from Cam-

bridge Computing and the AGF joystick. If you buy a Kempston joystick you will usually need a conversion cassette for the games you intend to play.

The conversion software on the Kempston cassettes will take care of the programming of the interface. You will not have to go through a lengthy procedure of getting the connections in the proper place or making sure that the programming has been done once you have entered the game you intend to play.

One of the uses of a programmable joystick which has not been investigated is compatibility, first with graphics adventures and then with text adventures.

The first graphics adventure on the Spectrum scene, **Black Crystal** from Carnell Software, can be used with a joystick. That means you can move the adventurer round the maps incorporated in the game without having to use the keyboard.

The effects of a joystick on this adventure are not particularly pronounced, as it is written in Basic and is slow. It is one instance where the use of a joystick is questionable.

As an extension to joystick use in graphic adventures, the direction commands in text adventures can, in some instances, be programmed into a joystick interface.

That is possible only with adventures which will allow the use of mnemonics such as N for North and S for South, where directions are concerned.

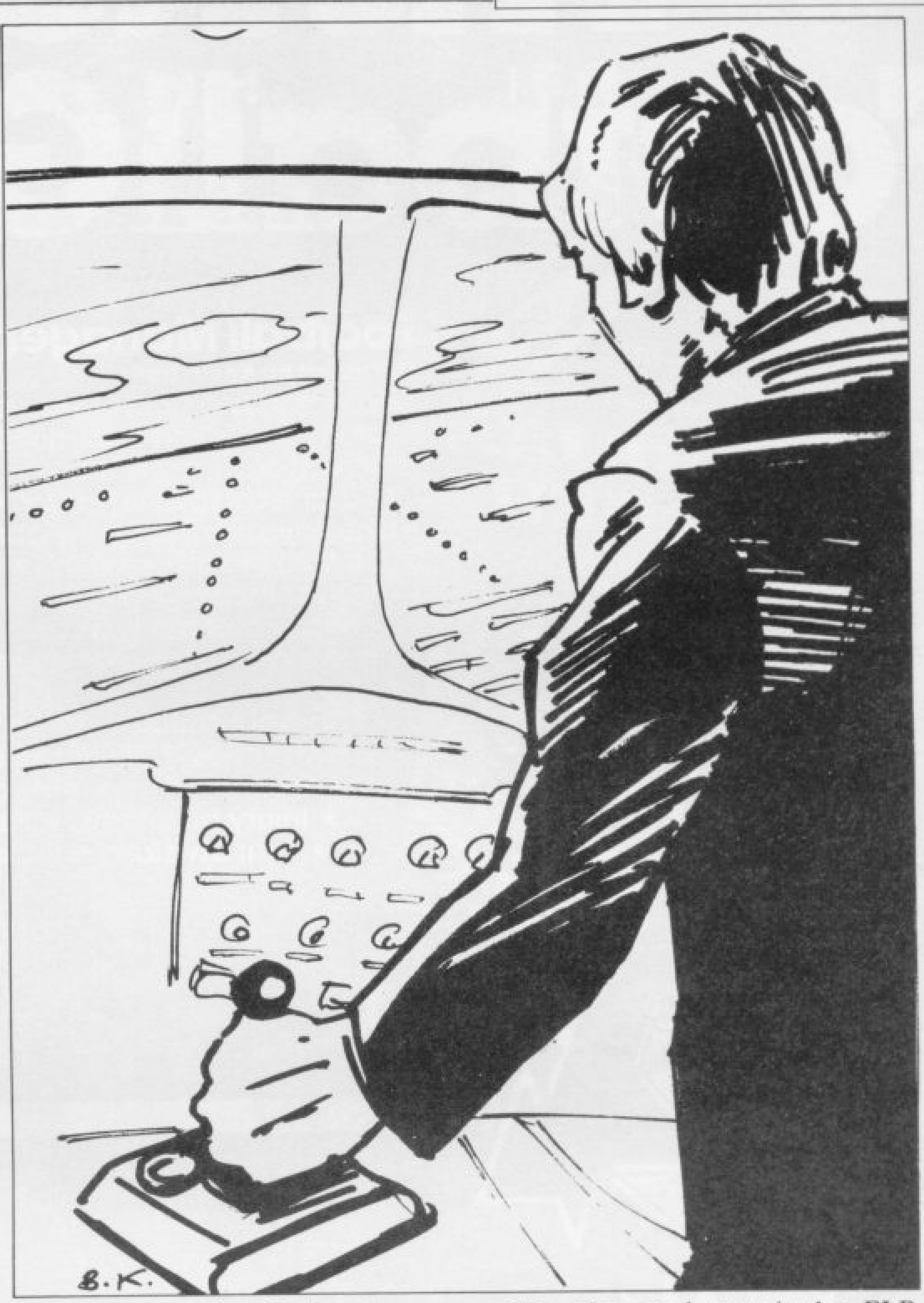
Two examples for which it may be possible to use joysticks are **The Hobbit** and **Valhalla,** which could be described as a graphics adventures.

Simulation software is also ideal for conversion to joystick. **Flight Simulation** is an obvious choice in this area of the game in manoeuvre-making. The joystick transforms it from a good simulation to an exciting and stimulating exercise in realism.

Another piece of software from Sinclair which is both a game and simulation is **Chequered Flag.** In it you are in control of a racing car and have to go round one of several famous tracks.

All the action is in 3D and you should find a joystick an advantage, because if your reactions are not fast enough you could either crash into the side of the track or skid on some oil. While we found the joystick helpful we have not been able to beat the track record.

One final simulation which could benefit from a joystick is the **Train Game** from Microsphere. In it you have to move round a track, picking up passengers at stations before they are over-run, and switch points to avoid crashing.



With a programmable joystick you could manipulate the direction in which the train is travelling and use the fire button to switch the points. The Train Game is easy to use with the keyboard but it improves with the aid of a joystick.

The future of joystick software seems to be assured. New types of joystick are being created for the Spectrum all the time and one of the latest, a version of the Apple Le Stick, is the Trickstick from East London Robotics.

The stick resembles a large tube which you hold in your hand and, by tilting it at different angles, you can make your figures in the computer games move in the corresponding direction.

The other good news is that ELR hopes to make the device compatible with all software.

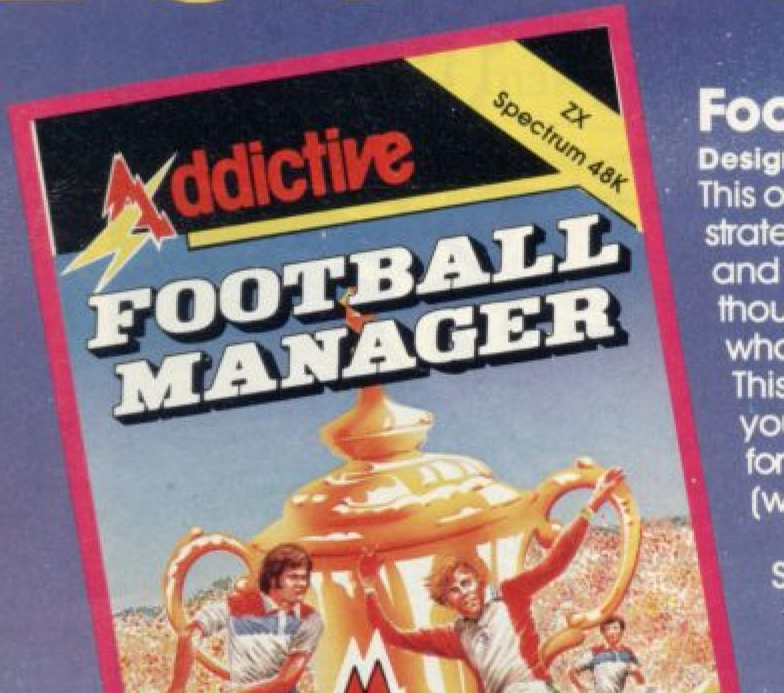
The use of joysticks can only aid the games player. It also provides a much-needed new area into which games can go.

We may soon see games being developed specially for joystick control. That will give the games sector a new lease of life, as they become more complex, realistic and enjoyable. The age of the keyboard as the sole input device could be ending.

Sinclair Research, Stanhope Road, Camberley, Surrey GU15 3PS.
Ultimate Play The Game, The Green, Ashby de la Zouch, Leicestershire LE6 5JU.
New Generation, Freepost, Bath BA2 4TD.
Imagine, Mason's Building, Third Floor, Exchange Street East, Liverpool.
Microsphere, 72 Rosebery Road, London N10 2LA.

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*ZX81 Chart, Home Computing Weekly 16.8.83

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Setting up a standard for data transmission

Stephen Adams unravels some of the mystery surrounding the RS232 and explains how to connect the device

WITH or without the C, RS232 is much-used to describe a way of transmitting data without telling you much how it intends to do it. The so-called standard is set out in the Institute of Electrical and Electronic Engineers library as a list of specifications for a serial interface, along with a standard 25-way "D" type connector.

So far as the computer industry is concerned, the IEEE might as well not have bothered. The only thing on which anyone agrees is that the output is Serial — that is one binary 0 or binary 1 is sent at a time.

I hope to untangle the mess of RS232s and provide some help on setting-up a connection between the two. If you have listened to Morse code on a radio, that is exactly how RS232 data is sent. Instead of different sounds, though, different voltages are transmitted.

That is usually taken from a byte of data eight bits long which is represented normally in the computer by eight wires, each carrying a binary 1 or a binary 0 — +5 volts or 0 volts. The maximum number of combinations from those eight bits is 256 and they can vary between 00000000 — eight zeros — and 11111111 — eight ones.

The language which computers use to talk to each other is called American Standard Code for Information Exchange and is made up only of seven bits of binary information. That covers all the letters, numbers and printable symbols between the numbers 32 — space — and 127 — usually delete. The lower 32 numbers from 0 to 31 are what is called control codes and are used to indicate to the computer or other devices, such as printers, that it is a command which should be done and not printed. Some of them are used to control the sending of information such "this is the start of the message" — STX code 2 — and "this is the end of the message" — ETX code 3.

All data to be sent is usually made up of seven bits and the data must be altered to fit into the seven-bit format.



If it is eight-bit data or code it is usually split into two hexadecimal — 2 to the power of 16 — characters. They will be from 0 to F each and thus fit into the ASCII character seven-bit code. Eight-bit characters can be sent but special arrangements must be made in the sending and receiving RS232s so that they recognise that eight-bit characters are being sent and do not corrupt the last data bit. So that is one parting from the standard that 8 or 7 bits of data can be sent.

Rule one is to check how to set up both devices to seven- or eight-bit working. If no setting is possible on one device, it should be set up for that type.

A parity bit is sometimes used to check that the data sent is the data received. That is done by inserting an extra bit into the data at the end, saying whether the data sent is an odd or an even number of binary 1s — odd or even parity. If even parity is used, the parity bit is 0 when the number of binary 1s are an even number and 1 when they are an odd number, thus making the sum of the bits always an even number.

Odd parity is the opposite, always making an odd number of binary 1s. That is required only by some modem systems and, given the choice, parity bits should be omitted at both ends. If parity is used it must be the same at both ends.

Continued on page 54

Continued from page 53

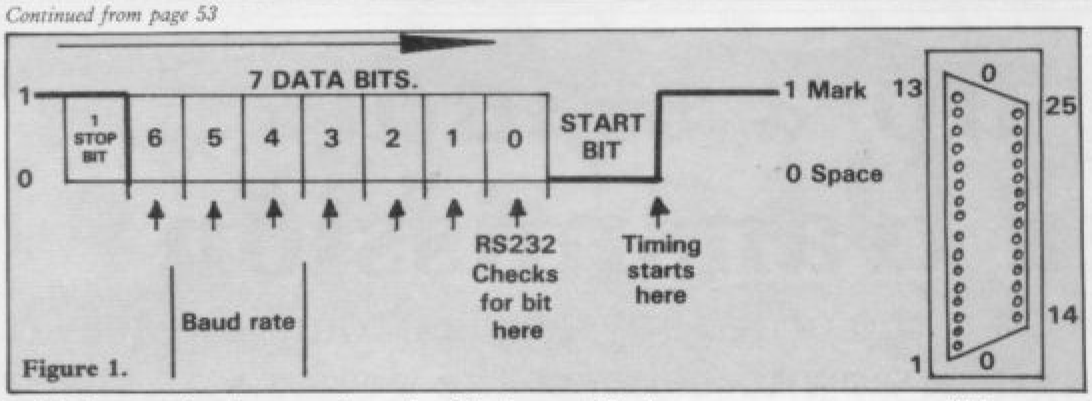


Figure 1.

Rule two is that parity should be omitted if possible. If not, it must be the same at both ends. It is usually set by a switch inside the computer or RS232 device.

At the beginning and the end of each data byte — seven or eight bits — are sent a START bit and one or more stop bits. The receiving equipment can recognise them as the start and end of the data. That is important, as data may be sent as the occasional byte or streams of bytes and it is called Asynchronous working — i.e. data is not being sent continuously which would be Synchronous working.

The start and stop bits are inserted by the RS232 device and are taken out at the other end, so that they never become part of the data. The Start bit is always a single binary 0 — binary 1 is sent continuously until the start of data — and the Stop bits are always binary 1s.

So the transmission of data always starts with a change from 1 to 0 and then reverts to 1 at the end of the data for at least one time period. Another word for binary 1 and binary 0 is called MARK and a SPACE when used with an RS232 — see figure one.

Rule three is to set up the number of STOP bits. The START bit is always set to one. One or other of the devices will more than likely be set to a fixed number of STOP bits. The more stop bits used the more reliable, but slower, the data sent.

The number of bits which can be sent in one second is called the baud rate and it is that which determines how long a bit of data must be. It is used usually to check what time the receiving RS232 should be looking for a data bit. The timing is taken from the start of the first bit received — the START bit — so it is important that both devices are accurate in the speed at which they are operating and that they both work at the same speed.

If they were operating at different speeds, the place in time they would be looking at for sending and receiving data would be different and only rubbish would result at the receiving end.

To be as accurate as possible most RS232s use a crystal-controlled clock frequency, which is then divided by at least 16 times to make it even more accurate by the RS232 device. On interface One the timing is done by the Z-80A microprocessor and so that is not done — all timing is done by software.

That is very important, as speeds of up to 19,200 baud may be required. As most RS232 devices can work at different speeds for different jobs — 300 baud for a modem and 2,400 for a printer, for instance — the speed must be set to be the same at both ends.

Rule four is to set up the baud rate at each end to the same speed. Use the maximum speed possible between the two devices. If you are having problems, reduce the speed of both devices to see if it improves. Handshaking with control lines improves the speed at which the RS232 will work reliably.

> 'The start and stop bits are inserted by the RS232 device and are taken out at the other end'

The way data is represented according to the standard is via a voltage of at least three volts, either positive or negative, and a maximum of 15 volts, the positive voltage being binary 1 and the negative voltage binary 0. The computer usually uses only voltages of 0 volts and +5 volts internally and so they must be converted into positive and negative ones.

That is the most common divergence from the standard; an RS232C device should be capable of handling the voltages specified; if they do not, damage will result, if they are connected to a proper RS232C device. Therefore an RS232 device which gives only 0 to 5 volts — as on Commodore Vics — or gives only +/− 5 volts, as in the case of the BBC microcomputer, needs some changes before it can be used with a proper printer.

The Interface One used on the Spectrum gives both those voltages. Some RS232 devices do not have a negative voltage supply and thus cannot give the correct signal for a binary 0, which can lead to errors.

Others steal the negative voltage from the other device and use that to reply. Those types of devices therefore cannot be used together, as at least one should have a negative supply.

True RS232 devices therefore should have a positive and negative supply, usually of 12 volts. They should also respond only to positive or negative voltages greater than three volts and ignore any lower voltages. That makes the RS232 device fairly free from noise picked up on the line between the two devices. That is another usual failure by RS232 device manufacturers, that of failing to recognise 0 volts as a binary 0 and not as a fault. That fault could be due to a power failure in one of the devices.

Rule five is to check that the voltages used by both devices are to RS232C standard and are not marked TTL — transistor transistor logic — as used in ICs.

The connection between the two devices is specified as a 25-way 'D' type plug on a cable not usually greater than 50 feet — a female socket on the data terminal equipment side and a male socket, with pins, on the DCE side. The DTE is usually the computer and the DCE is usually the controlled device. That is where the confusion really starts.

The first thing is that, because of the expense of that type of plug and the fact that most manufacturers do not require all 25 pins of the socket, the type of socket is being changed. They can be anything from an edge connector to a 9-pin Atari-type joystick socket as used by Sinclair. Din plugs like those used on tape recorders and hi-fi are also popular, as they can provide anything from three to seven pins on plugs, most of which are incompatible with each other.

Printers have also been affected by the same problem, so you may need a special cable made up. Some manufacturers have ceased to stock various types of cables and provide you with just the bare wires to attach to a plug of your choice.

Rule six is to make sure you can get a cable or connectors for both ends. They may be completely different. The reason that plug was chosen was that it would cope with all the control lines as well as the data lines required between

the computer and another device. The control lines are called handshake lines and can be inputs or outputs. They also had a specified place on the plug, so that every one needed only to have a straight cable from one piece of equipment to the other. Different conditions could then be set either on the computer or the other device to make them compatible. The standard plug and their pin descriptions are detailed in figure two.

It would be unusual to find a device where the socket is wired the same way or, in the case of microcomputers, whether the socket is used at all. You must therefore be able to locate, in the manuals supplied, the connections for the two devices to connect them.

Rule seven is to check that your manuals for the computer and the RS232 device have pin-by-pin description of the socket. If you want a cable to be made up, you must supply that information to the shop.

The standard descriptions of what the RS232 pins do in the computer or device is also essential, as they may stop the operation completely if left unconnected. Pins with the same initials are not usually connected, as they usually do the same job.

Let us take the usual reason for using an RS232, a printer, as an example. Transmitted data from the computer must be connected to RX data on the printer. If another device is used TX data from the computer must be connected to RX data on the computer. On the Spectrum Interface One those are labelled differently, as TX data is an input.

Any signal with a horizontal bar over the top of it ($\overline{DCD}$) operates to a binary 0 and those without to a binary 1. Some of those signals cannot be controlled by the computer — the Spectrum has only two control lines — and they must be connected to either +12 volts — binary 1 — or −12 volts — binary 0.

That sometimes can be done by a switch in the printer or on the RS232 device connected to the computer. On the Spectrum Interface One, use the pin outputs containing +9 volts and 0 volts instead.

The minimum connection can be done by connecting the data line from the computer to the printer and the common return line. The common return gives the standard by which the printer knows whether it is positive or negative signals being received. That is the only line which must be connected to the same place on both printer and computer. If it is left unconnected the printer will not work.

Rule eight is to set any connections not made between the two devices to binary 1 or binary 0, either by a switch or a wire connection in the plug. Control — handshake — lines which are usually available are:

REQUEST TO SEND (RTS) which tells the device that a data byte is being sent.

CLEAR TO SEND (CTS) which tells the device that it is sending a byte in the other direction.

DATA TERMINAL READY (DTR) which tells the device that is free to receive a byte of data.

DATA SET READY (DSR) which acts in the same way as DTR.

Whether they are inputs or outputs depends on whether you are looking at the printer manual or the computer manual. Any inputs must be connected to an output but any spare outputs can be left disconnected.

For a simple set-up on Interface One connect RX to TX on the printer, TX to RX from the printer — if provided — CTS to DTR — so that the Spectrum turns on the printer when it is sending a byte — RTS on the printer should be connected to DTR on the ZX Spectrum.

That last connection is important as the RS232 on Interface One is working only when DTR is high — binary 1. If DTR is low — binary 0 — the Spectrum waits for DTR to go to binary 1. The printer then inhibits the Spectrum, only when it cannot take any more data, by dropping DTR to binary 0.

If that is not done, because the printer is slower than the computer, characters may be lost. If you do not have a signal from the printer line, then DTR on the Spectrum will have to be connected to +9 volts and the speed reduced on both devices so it can work without handshaking.

Rule nine is to find what the connections do; they may be different on both devices, but still use the same letters. Always remember that input goes to output.

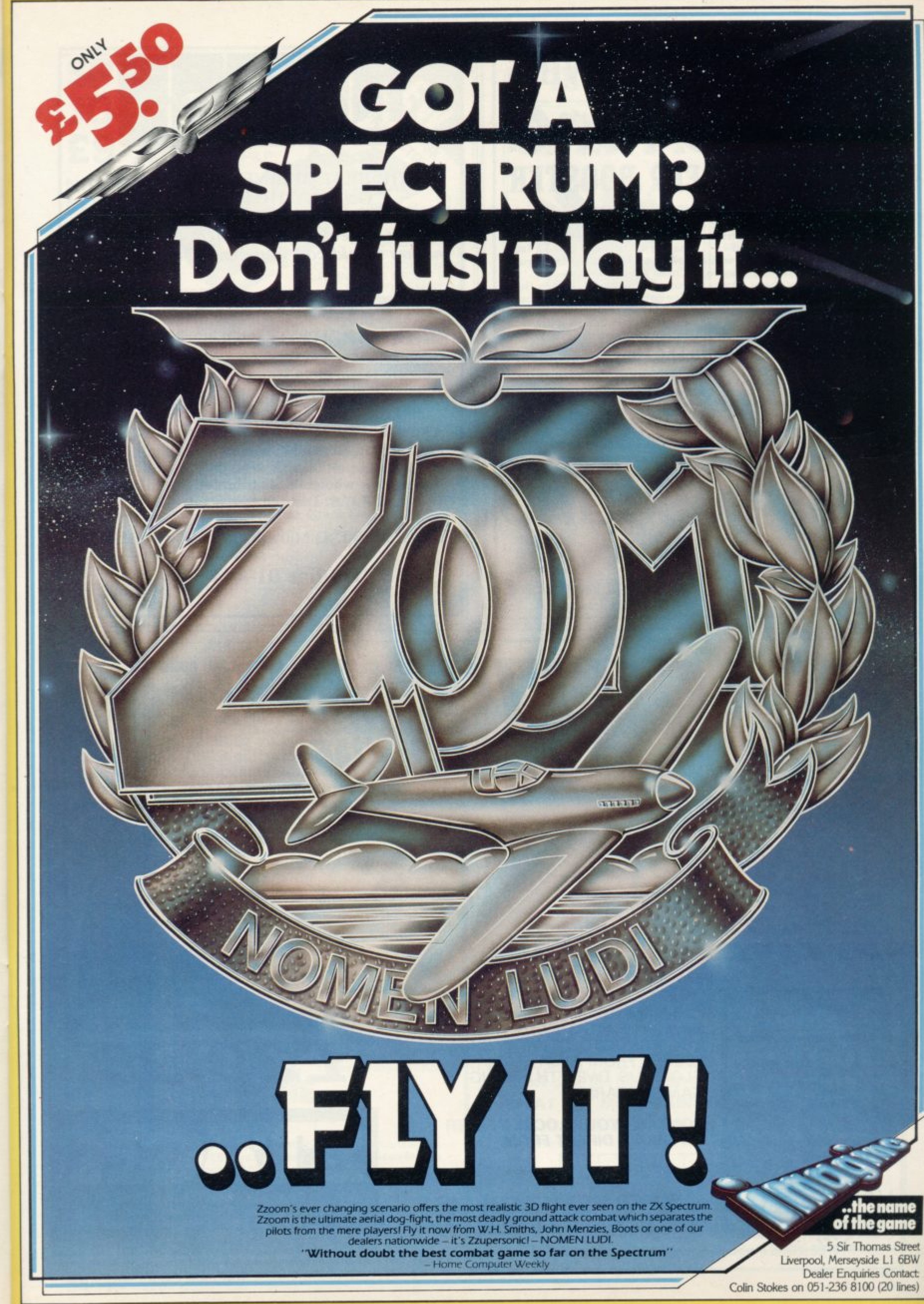
You should now have some idea of how to connect a printer to an RS232C device on a computer. You should also know what questions to ask when buying an RS232. Each of the descriptions I have given as examples are the standard ones. Your printer or RS232 manufacturer may have different ideas, so it is always worthwhile to check.

On other devices, such as modems, some scientific devices and some musical instruments, data is transferred both ways. In that case you must split all the control lines into two sets, one for the transmit direction — from the computer — and one for the receive direction — to the computer. They may work as two independent units inside the computer and so the control signals for the transmit may have no effect on the receiver.

Rule ten is to remember that TX and RX data both have their own set of control lines.

Figure 2.

PIN	INTLS	DESCRIPTION
1	GND	Protective ground (0 volts)
2	TX	Transmit data
3	RX	Receive data
4	RTS	Request to send
5	CTS	Clear to send
6	DSR	Data set ready
7	GND	Signal ground (0 volts)
8	RLSD	Received line signal detector (for modems only)
9	TXT	TX timing signal
10	STBY	STBY indicator (for modems only)
11		Select frequency
12	SCF	Secondary RLSD
13	SCB	Secondary CTS
14	SBA	Secondary TX
15	DB	Transmit timing from DCE device
16	SBB	Secondary RX
17	DD	Receiver timing from DCE device
18		Not used
19	SCA	Secondary RTS
20	CD	Data terminal ready
21	CG	Signal quality detector
22	CE	Ringing indicator (modems only)
23	CH/CI	Data rate selector
24	DA	TX timing from DTE
25		Not used


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How Flight Simulation soared to the top of the charts

In the first of a series on top programmers. Nicole Segre talks to Charles Davies, the man behind Psion's best-selling game

CHARLES DAVIES, originator of the best-selling Psion program **Flight Simulation,** is matter-of-fact about the reason for its success. "There is nothing else as good of its kind on the market," he says.

Since it was released early last year, the Spectrum version of the game has climbed the popularity charts, steadily holding top position for many weeks. More than 130,000 copies have been sold; it was translated recently into Spanish and is doing well in the States.

"I do not know who our customers are," says Davies, "but I know that several squadron leaders have written saying how much they liked the program, including one in Greece who wants to use it as a teaching aid in his flying school."

Flight Simulation puts you in the cockpit of a small aircraft. The lower half of the screen shows a complete bank of instrument panels, including altimeter, fuel gauge, airspeed indicator and power guage, and the upper half of the screen shows the view from the pilot's window.

As you bank, dive or climb, the horizon moves accordingly, as do the three-dimensional runway, landmarks and beacons. Real flight conditions are reproduced faithfully, down to air-flow, angles of approach and rate of climb, and there is a navigational chart to show your position at any stage of the flight.

Even after you have mastered the complicated set of keys representing the various controls, piloting the aircraft from take-off to landing without having a disastrous crash is a difficult task which takes many hours of practice.

"The game teaches the things a pilot needs to know — how to move maps in your head, how to move an aircraft by banking rather than turning, how to climb by increasing power rather than pointing up the nose, and so on," Davies explains.

The authenticity of Flight Simulation, together with its striking graphics, were the result of a great deal of hard work. Davies wrote the original program for the ZX-81 and it took him three months. "Although flight simulation programs existed on mainframe computers, there was nothing like this for a micro" he says.

"Everthing had to be worked-out from first principles, from the aerodynamics to the perspective and 3-D transformations of the view. It took a great deal of very complex mathematical equations to get it correct and I thoroughly enjoyed doing it."

The ZX-81 game proved to be such a success that the rapidly-expanding Psion company soon decided to produce a more elaborate version for the Spectrum. "Everybody took part in that," says Davies.

One programmer, Luigi Ronchetti, worked full-time on the project, under Davies' supervision, for more than four months, and for several months after that eight others took charge of individual parts of the program. "It took one person two weeks to design the dials," Davies recalls.



Now the director of a company which employs 35 people, Davies entered computing via a roundabout route. Looking much younger than his 29 years, Davies was born in Cardiff and attended a Welsh-speaking comprehensive school near Pontypridd. There he quickly showed an aptitude for mathemathics and science.

"I was lucky," he says, "since the staff at the school were all very involved in the Welsh-speaking cause and consequently deeply-committed to making the school a success. The quality of the teaching was excellent. On the other hand, the science subjects were taught in English, so I did not learn a great deal of Welsh."

After taking mathematics, physics and chemistry at A level, Davies read physics at Imperial College, London. He took a PhD in plasma physics and stayed to do post-doctorate research work at the college. Much of his work was on computers and in his 11 years at the college Davies became thoroughly conversant with Fortran.

His supervisor was David Potter, who in 1981 did what Davies calls "an unheard of thing"—resigned his lectureship to start his own company.

Potter, Psion founder and chairman, had for some time felt disillusioned with university life. "Funds were being withdrawn and there was a general watering-down of opportunities," Davies explains. "Anyway, physics has been going downhill since 1927, the time when relativity and quantum theories overturned all the textbooks and created fireworks all round. Nowadays, things happen much more slowly."

Tempted by the challenge of the fast-developing micro scene, as well as by the cut and thrust of the business world, Potter established Psion Computers, first to export the Acorn Atom and the ZX-81 to his native South Africa. Soon afterwards he asked Davies to join him to start producing micro software. Davies accepted the invitation willingly.

"At the time, neither of us knew much about micros," he says, "but we were computer-literate and our experience of bigger machines made it easy to pick things up quickly. We had also used many simulations in our physics research, which no doubt helped set a trend for our future software."

Flight Simulation, produced in a first timid batch of 250 cassettes in September, 1981, not only allowed budding pilots to take to the air but quickly sent the new company soaring. "Last month, the factory with which we started produced 500,000 cassettes for us,"

says Davies. Psion now sells its entire Spectrum production to Sinclair Research, which deals with all the advertising and distribution of the cassettes.

The arrangement leaves Psion free to concentrate on creating software, which is done by a team of 22 full-time programmers, of whom the youngest is 17 and the oldest 35.

"We like our programmers to have a sound mathematical background," says Davies, "but we do not insist on it. Although training helps to make a good programmer, some people with very little education seem to have an in-born talent for computing and that is good enough for us."

One thing the whole team has in common is that they are all what Davies calls "keyboard junkies."

"Everyone is getting paid for what they love doing anyway, so morale in the company is very high," he says.

At present no new game for the Spectrum is in hand. Maintenance of current production is one priority, which chiefly means eliminating bugs which have been discovered and translating games into other languages for export. The team is also gearing to produce software to run on a variety of machines.

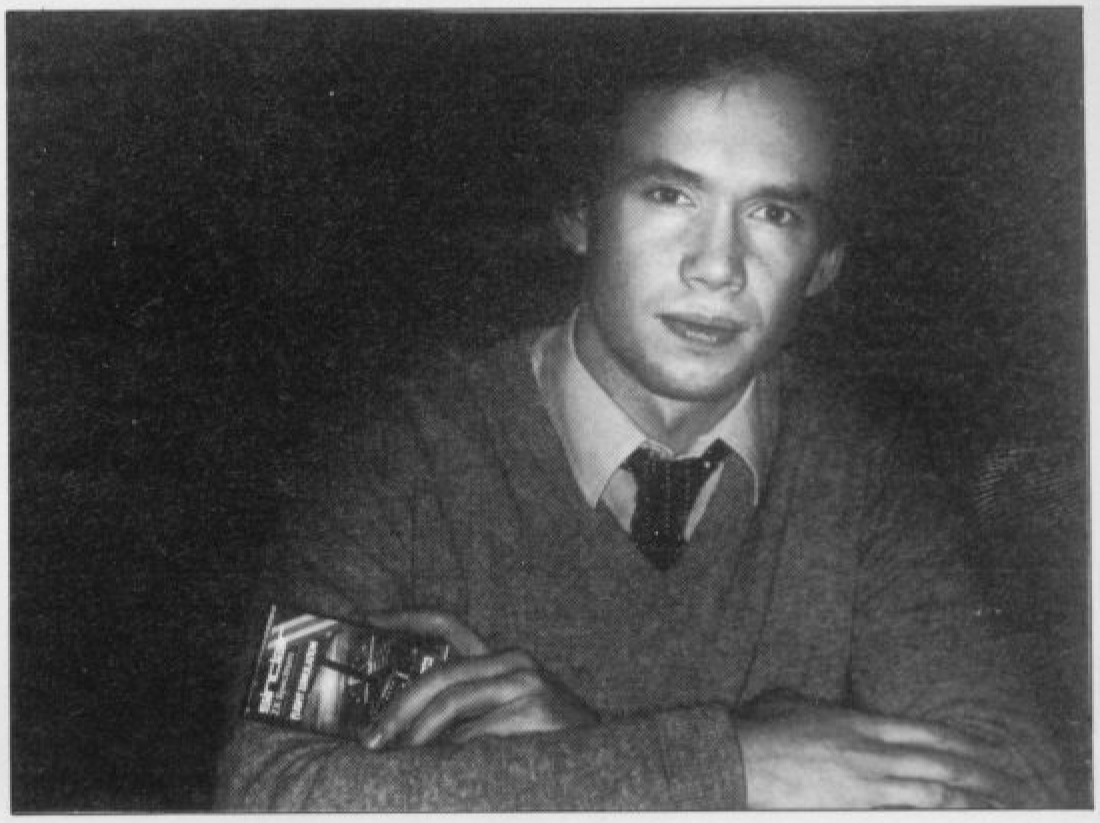
"For the last six months we have been working in C, which we think is the best and fastest of the high-level languages. Certainly it is becoming very popular in computing circles", Davies explains. "We do not drive Porsches," he adds, "but we program on the raciest of computers". The aim is to produce programs in a processor-independent way and the team works on two VAX computers, which Davies terms 'superminis', linked to 15 terminals; the programs are then assembled to run on any particular smaller machine.

"Writing programs in C makes it easy to adapt them very quickly to any computer we like," Davies says.

Although the Spectrum is still top of the Psion list, the company has its eye on the BBC micro and the Commodore 64, and also has plans for business software produced on floppy discs.

"After we have made some progress on all that," Davies says, "we will certainly produce a new Spectrum game but there is no point in bringing-out anything mediocre because it will not sell. Our next game has to be something we can make a song and dance about and that will take a few months at least."

Although not an avid games player, Davies loves writing them. He finds the skills they require far more interesting



than those needed for serious applications. He also thinks there is plenty of life left in the games market and that the standard of commercially-produced software will continue to rise.

He predicts that by the spring, when the traditional post-Christmas lull in sales takes its full toll, many smaller companies will be forced from the software scene for good.

"People like ourselves have already built a considerable advantage," Davies says. "As well as experience and a solid reputation, we can draw on our software library resources and we also have a good deal of excellent and very expensive equipment with which to work. It is difficult to see how anyone working alone in a front room can compete."

Looking further ahead, Davies is convinced that in five years every home will have a computer, not just to play games but to keep accounts, file, write and edit, interact with other databases, carry-out banking transactions and consult expert systems on anything from child care to motor mechanics.

"I can see members of a family arguing about who uses the computer in the same way people argue about which television channel they want to watch now," he says.

His confidence in the future is reflected in the fact that Psion is soon to move from the converted factory in a quiet London mews it occupies to new premises nearby with space for up to 80 people.

In spite of company expansion, Davies remains as closely involved with programming and as enthusiastic as ever. He is at his desk by 8 o'clock in the morning and admits to being "a bit of a workaholic". Although he once liked running and playing squash, he says he now has time for neither, and has not had a holiday for a long time. "Luckily my wife has a demanding career of her own, so she does not mind my absence too much," he says.

Davies has no regrets about giving up the security of an academic career for the pressures of the business world. "The micro scene is full of excitement and vitality," he says. "There are still a tremendous amount of new skills and ideas to develop. This is just the beginning."

Spectrum Top Ten

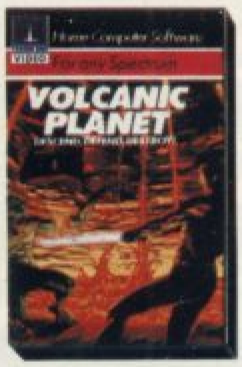
	Program	Last month	Company	Memory
1	Flight Simulation	4	Psion	48K
2	Lunar Jetman	—	Ultimate	16K
3	Kong	—	Ocean	16K
4	Zzoom	—	Imagine	48K
5	Ant Attack	—	Quicksilva	48K
6	Pool	—	CDS	16K
7	Trans-Am	5	Ultimate	16K
8	Zip Zap	—	Imagine	48K
9	Bugaboo	—	Quicksilva	16K
10	Pssst	—	Ultimate	16K


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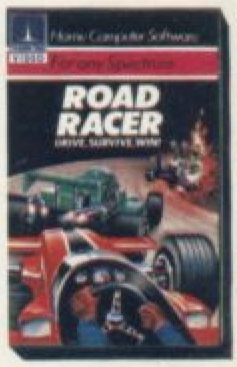
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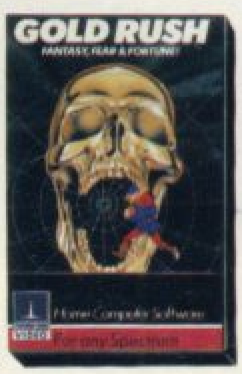
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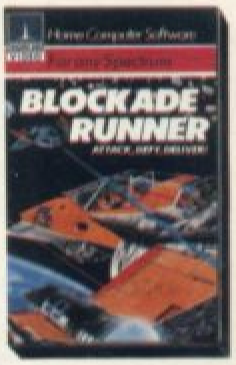


In "Road Racer" (on 16k) you'll find out if you're skilful enough to drive round a terrifying track at death defying speeds, and reach the black and white flag in one piece.



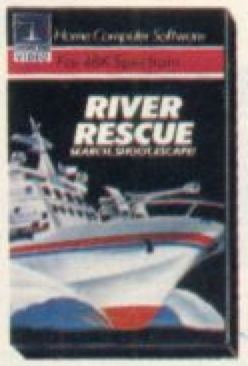
"Gold Rush" (on 16k) is no walk-over either. Underneath the eerie planet of Oron is a vast cavern full of gold and demons.

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In "Blockade Runner" (on 16k) the earth is under siege and you must get life-saving supplies through.

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"River Rescue" (on 48k) is a runaway success on other formats. It's now available on Spectrum. You'll have to navigate the wildest and most dangerous river on earth in a powerful patrol-boat. But keep a sharp look-out for the killer crocodiles. They haven't eaten all day.

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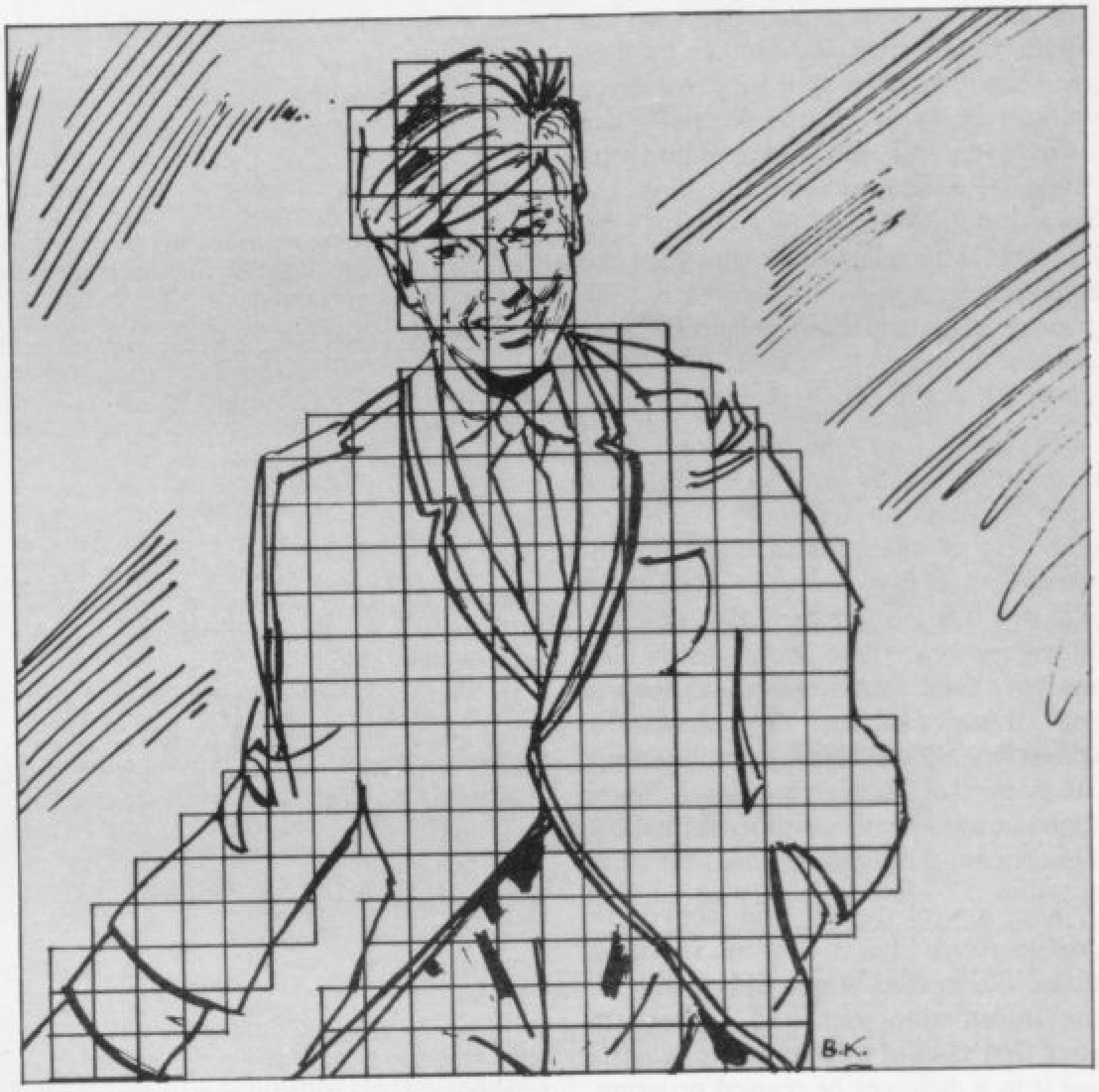
In the first of a series on machine code programming, John Kerrigan introduces some Spectrum graphics routines

I WANT to introduce some aspects of machine code programming to relative newcomers to the subject. For my illustrations I will use some routines for displaying graphics on the Spectrum screen. Experienced machine code programmers may find this series useful if they pass over most of the explanations and concentrate on using and adapting the routines.

It is a little more difficult to program in machine code than in Basic. Where machine code scores over Basic is its speed and use of memory. It is possible to display moving graphics on the Spectrum screen with a Basic program. Most Basic programs restrict movement to one area of the screen at a time and then the movement is by jumps of whole character positions. In machine code you can have the effect of a great deal of movement in several parts of the screen at apparently the same time and the movement can be much smoother. In machine code a figure can be shifted right, left, up or down by one-eighth of a character.

The Spectrum screen consists of 24 rows of 32 characters. In Basic, the screen may appear smaller because the bottom rows are reserved as edit lines. In machine code the whole of the screen is equally usable. Each character is eight pixels wide and eight scans high. Thus you can think of the screen as consisting of 192 scans — 24 rows and eight scans per row — by 256 pixels — 32 characters and eight pixels per character width.

Page 164 of the Spectrum manual explains how the screen memory is arranged. It says "it is rather curiously laid out". So it appears to be, so long as we count the memory addresses in the normal way to the base 10. It makes more sense if we count the way machine code programmers count, to the base 16. That system of counting is called hexidecimal, or hex for short. The system is identical to normal counting up to the number nine. Normal numbers 10,11, 12, 13, 14 and 15 are denoted in hex as AH, BH, CH, DH, EH and FH.



The normal number 16 becomes 10H. The 'H' after a hex number should prevent confusion between the two counting systems.

The Spectrum screen memory makes more sense if you express it in hex. The screen memory starts at the normal number 16384 which proves to be 4000H and continues until 57FFH. It is split into three sectors of 800H addresses each. Sector 0 runs from 4000H to 47FFH; sector one runs from 4800H to 4FFFH; sector two runs from 5000H to 57FFH. That means that sector 0 covers character rows 0 to 7; sector one covers character rows 8 to 15; sector two covers character rows 16 to 23.

> 'The Spectrum manual says the screen memory is rather curiously laid out. So it appears to be so long as we count the memory addresses in the normal way to base 10.'

Typically all literature on machine code starts any count at the number zero; so, although it was said that there were 24 rows, the last row has been denoted row 23.

The top scans — scan 0 — of all the characters in a sector are stored in

order, then all the scan 1s, all the scan 2s and so on until all the scan 7s. That means that the 23rd character on the screen has scan 0 at 4016H, scan 1 at 4116H, scan 2 at 4216H, scan 3 at 4316H, scan 4 at 4416H, scan 5 at 4516H, scan 6 at 4616H and scan 7 at 4716H. It can be seen that, counting in hex, there is a relationship between the scan numbers and the address.

Each address consists of four hex digits but each register of the Z-80 chip can contain only a byte or two hex digits. So to store an address in Z-80 registers it must be split into two parts. It must be split into the Most Significant Byte and the Least Significant Byte. The address 4016H would be split into an MSB of 40H and an LSB of 16H. The relationship between the scan numbers and the address is that, for any individual character, as the scan number increases so the MSB is incremented and the LSB remains the same.

Of course, if we want to make full use of graphics on the Spectrum screen we want to think in terms of pixels and scans rather than characters. We will need routines to move up a scan, down a scan and left and right across the screen. In figure one there is an assembled machine code routine to move down a scan. It has been given the rather uninspired title S0. In later articles I will use S0 as part of bigger routines to show figures on the screen and to shift those figures in different directions.

The top of figure one above the double ruled line is headed Specifications. The specifications should give all the information we need if, months after first coding a routine, we wish to use it in a different or revised program. GENERAL DESCRIPTION is self-evident. ON ENTRY tells us what must be done before we enter the subroutine. ON EXIT tells us how to interpret the results from the subroutines. USES tells us which registers are used by the subroutine and thus, by implication, which registers are used by the subroutine, and thus by implication which registers are not used. In this case, if there are values in the Z-80 registers which will be needed after this subroutine, it would be safe to leave them in registers B or C but they would be destroyed if they were left in registers, A, D, E, H or L.

For anyone who has never seen an assembled routine previously, the rest of figure one below the double-ruled line may look incomprehensible. The figures in the left-most column are memory addresses in hex; in the next left-most column the line numbers for lines of assembly language. Then there is a column for labels, if any. That is followed by the assembly language mnemonics and then, after a semi-colon, are comments.

The program is the series of hex numbers in the second column, which must be placed after the address given in the first column. The assembly language mnemonics are not strictly necessary; they make it easier to write a machine code program. An assembler converts the mnemonics into hex numbers. It is possible to hand-assemble or to use an assembler program.

Experienced machine code programmers will be able to tackle the logic of S0 and will understand the meaning of the mnemonics. For the benefit of newcomers, turn to figure two, which contains the routine S1. S1 is simpler, shorter and less useful than S0. S1 fills

Figure 1.

SPECIFICATIONS S0 — ZX Spectrum.
GENERAL DESCRIPTION: Takes an address in screen memory and returns the address of the scan immediately below, unless the original address was on the bottom scan of the screen.
ON ENTRY: HL must point to an address in the Spectrum screen memory.
ON EXIT: If the entry HL was not on the bottom scan of the screen, then (a) the zero flag is re-set and (b) the exit HL will be one scan below the entry HL. If the entry HL was on the bottom scan of the screen, then (a) the zero flag is set and (b) the exit HL will be the same as the entry HL.
USES: A, D, E, H, L.

```
7000          00100         ORG 7000H
7000 7C       00110 S0      LD A,H        ;LOAD MSB
7001 E607     00120         AND 7         ;TOP 5 BITS NOW ZERO
7003 FE07     00130         CP 7
7005 CA0A70   00140         JP Z,ENLI     ;MUST BE ON BOTTOM SCAN
              00150                       ;OF CHARACTER LINE
7008 24       00160         INC H         ;MOVE DOWN 1 SCAN — REMAINING
              00170                       ;ON SAME CHARACTER LINE
7009 C9       00180         RET
700A 7D       00190 ENLI    LD A,L        ;LOAD LSB
700B E6E0     00200         AND 0E0H      ;LOWEST 5 BITS NOW ZERO
700D FEE0     00210         CP 0E0H
700F CA1970   0020          JP Z,ENSE     ;MUST BE ON BOTTOM SCAN
              00230                       ;OF SECTOR
7012 11E006   00240         LD DE, 06E0H
7015 A7       00250         AND A         ;RESET C FLAG
7016 ED52     00260         SBC HL,DE
7018 C9       00270         RET
7019 7C       00280 ENSE    LD A,H
701A FE57     00290         CP 57H
701C C8       00300         RET Z         ;ON LAST SCAN OF SCREEN
701D 112000   00310         LD DE,0020H
7020 19       00320         ADD HL,DE
7021 C9       00330         RET
0000          00340         END
00000 TOTAL ERRORS

ENLI    700A   00190   00140
ENSE    7019   00280   00220
S0      7000   00110
```

Figure 2.

SPECIFICATIONS S1 — ZX Spectrum.
GENERAL DESCRIPTION: paints full ink into the 17th position of the 12th row on the Spectrum screen.
ON ENTRY: No requirements.
ON EXIT: 4870H, 4970H, 4A70H, 4B70H, 4C70H, 4D70H, 4E70H and 4F70H will all contain FFH.
USES: A, B, H, L.

```
7000          00100         ORG 7000H
7000 3EFF     00110 S1      LD A,0FFH     ;SET ALL BITS
7002 217048   00120         LD HL,4870H   ;MID SPECTRUM SCREEN
7005 0608     00130         LD B,8        ;NO OF SCANS PER CHR
7007 77       00140 BCK     LD (HL),A
7008 24       00150         INC H         ;DOWN A SCAN
7009 05       00160         DEC B
700A C20770   00170         JP NZ,BCK     ;BACK IF FULL CHR NOT PRINTED
700D C9       00180         RET           ;RETURN (IN THIS CASE TO BASIC)
0000          00190         END
00000 TOTAL ERRORS

BCK     7007   00140   00170
S1      7000   00110
```

one character position in the centre of the screen with ink.

The first line starts with the number 7000 which is the start address in hex. The next column is blank because the following assembly language is not a true machine code operation and so the first line does not tell you to fill address 7000H with any particular number.

The next column contains 00100 which is the first line number of the assembly language program. The label column is blank. That is followed by the assembly language instruction which is "ORG 7000H". There is no semi-colon, and no comment, on the first line. "ORG" is short for origin and that first instruction tells the assembler which is the first address to be loaded with code.

The second line also starts with the number 7000 which is the start address in Z-80 code and the Spectrum screen hex. The next column contains "3EFF" which is the number in hex which should be placed in addresses 7000H and 7001H. 7000H should contain 3EH and 7001 should contain FFH.

The next column contains 00110 which is the second line number of the assembly language program. The label column contains the label of the routine: S1. That is followed by the assembly language instruction: "LD A,0FFH". After a semi-colon a comment explains that it sets all the bits in A. "Setting all the bits" means making all the bits equal 1. In screen memory 1 means ink and 0 means paper. "LD" is short for load. "A" is a register on the LZ-80 chip. FFH, or 255, is the highest number a byte can contain. "LD A,0FFH" has the effect of placing the number 255 in the A register.

The third line, assembly language program line number 120, contains the instruction "LD HL,4870H". Both H and L are registers on the Z-80 chip. That instruction will have the effect of loading 48H into the H register and 70H into the L register. 4870H is the top scan of the 17th character on the 12th line of the screen.

The fourth line, assembly language program line number 130, contains the instruction "LD B,8". B is another register on the Z-80 chip and 8 is the number of scans in a character.

The fifth line, assembly language program line number 140, has the symbol :"BCK" in the symbol column and contains the instruction "LD (HL),A". Brackets around HL mean "contents of". In other words treat the number in



that register pair as an address and load that address with the number in the A register. In this case the first time this instruction is handled the address 4870H will be loaded with FFH.

The sixth line, assembly language program line number 150, contains the instruction "INC H". That means increment — or add 1 to — the number held in the H register. The seventh line, assembly language line number 160 contains the instruction "DEC B". That means decrement, or subtract 1 from, the number held in the B register.

The eighth line, assembly language problem line number 170, contains the instruction "JP NZ,BCK". "JP" is short for jump. "NZ" is short for if the zero flag is not set. "BCK" is the symbol on the fifth line — program line 140. INCing and DECing single registers affects the zero flag — in the flag register on the Z-80 chip — according to whether the result is zero.

Thus the eighth line is setting-up a loop similar to a FOR/NEXT loop in Basic. There is a way of merging the seventh and eighth lines of this program with the instruction DJNZ and you may have seen that used in some published programs.

The ninth line, assembly language program line number 180, contains the instruction "RET". "RET" is short for return. In that case we will make it a return to Basic.

'If we want to make full use of graphics, we want to think in terms of pixels and scans rather than characters'

Figure three contains a Basic program which pokes the machine code of S1 into memory and the calls the routine with RANDOMISE USR 28762. 28762 is the denary, normal counting, equivalent of 7000H.

Figure 3.
BASIC Program to poke and access S1

```
10 REM SET STACK BELOW MACHINE
   CODE
20 CLEAR 28671
30 REM MACHINE CODE IN DENARY
40 DATA 62,255,33,112,72,6,
   8,119,36,5,194,7,112,201
50 REM POKE IT INTO MEMORY
60 FOR A=28672 TO 28685: READ
   B: POKE A,B: NEXT A
70 REM TRANSFER CONTROL TO
   MACHINE CODE
80 RANDOMISE USR 28672
```

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Some basic steps to storing Forth variables

Continuing his programming series, John Gilbert points out a few similarities between Forth and Basic

IN THE LAST few months we have been looking at the differences between Forth and other languages. This month we will look at the similarities between it and Basic and also give ZX-81 owners some good news.

First, though, we look at the way in which variables can be stored in the Forth system. As usual there are some differences from Basic and in this case the representation of numbers using machine code will provide an excellent route to the understanding of how variables can be used.

It is not necessary to know much about machine code to understand what is happening in the Forth stack when a variable is created but if you can follow the arguments about numbers you should have a better idea of what is happening.

The POKE statement in Basic stores a 16-bit number in a memory location. An 8-bit number can be anything from 0 to 255 in decimal or 00 to FF in hexadecimal. A 16-bit number is a multiple of the first 8-bit number. It can range from 0000 to FFFF in hexadecimal.

To enter a 16-bit number on to the Forth stack as a variable we have to use a Forth dictionary word to define it. The word is:

VARIABLE

and the value of the variable goes before it and its name follows it.

To create a variable called VARS and enter the number 50 the following line could be used:

50 VARIABLE VARS

There must be a space between the 50 and VARIABLE and between VARIABLE and VARS.

If you press ENTER, your variable will be stored by the system. The value is not stored necessarily on the stack but the memory address at which it is stored goes on to it. When you ask for the value of the variable you have created, its address is on the stack and can be used as an index to the value which is being stored elsewhere.

It is similar to the way in which Basic variables seem to operate for the user where the variable name, in this case VARS, is used as an index to represent a value, which is 50 in this case.

To get back the value of the variable we will need a new Forth symbol which means, for our purposes, Fetch. It is symbolised with an '@' sign. To get back the 50, using the VARS name as an index, all you have to type is the variable name, together with Fetch and the printing dot. All three symbols have spaces between them:



VARS @

The screen display should then include

50 ok

As an extension of the variable technique, it is possible to create what in Basic would be called an array. For those with little knowledge of that type of data structure, an array is a table or list of values which are indexed, or named using one 'overall' label and a distinct index number for each of the elements. For instance, we could give our example array the name VALUES, tell the computer it contains 10 elements, and then number each of them from one to 10.

First we would need to clear space in the Forth dictionary, into which we will put our values. When a numeric array is dimensioned in Basic, the system gives each element the value of zero. For our purposes and, just to be awkward, we will give our array the initial value of one.

To do so we will have to use another new Forth word called ALLOT which has the function of giving the specified number of elements to our array. The line to dimension the array is:

1 VARIABLE VALUE 10 ALLOT

That should be followed by ENTER.

Taking the line apart, the number '1' is the initial value given to the array; VARIABLE will allocate a variable space for the array; VALUE is the name of our array and 10 is the number of elements in it.

Each of the elements is one byte long and so it is not possible to hold one number in each one. We have to pair those 8-bit bytes into 16-bit words to store our 16-bit values. That means we can store up to six values in our array.

If you thought that creating a variable was difficult and you did not like the idea of indexing and machine code addresses, you will be pleased to learn that there is another way of creating an integer variable, or one which does not contain a decimal point. Using the following technique, the computer will put the value of the variable and not its storage address on to the stack.

As with all Forth words, the value of our variable is put first on to the defining line. That is followed by the dictionary word, CONSTANT. This word tells the computer that you want to assign a value which has been put on to the stack with a label, just as would happen in Basic. Following this defi-

continued on page 72

nition we must put the name of the label, which we will call DEF:

50 CONSTANT DEF

After you have pressed ENTER you can refer to that value on the stack by the name DEF.

In a previous article in the series, I discussed ways of creating and editing screens of information and the way in which they can be SAVEd on to cassette for later recall. At that stage I omitted to explain how to SAVE dictionaries you have created until you understood more of the basic structures of the language.

When you have made your own Forth words the dictionary is termed to be extended and so SAVEing is more difficult than if you had an original, untouched, dictionary.

First we have to find the total length of the dictionary and we do that by typing:

SIZE

It is then necessary, with Abersoft Forth, to change the values for the operation of the cold start into Forth. That is done by typing-in the code which is listed on page eight of the manual.

You must then return to Basic and change the bootstrap loader program to give the number of bytes used by the dictionary and then add 10 to it. You can then SAVE the new version of Forth by GOing TO line nine. In the introduction, I promised owners of ZX-81s who are also Forth followers that I had some good news. A company is producing a ROM chip for the machine which can be fitted internally and will give the humble ZX-81 the capabilities of, say, the Jupiter Ace. The only problem is that once the ROM is fitted Forth becomes the origin language and it will be available on power-up.

The software gives access to a full-screen editor, on to which you can enter

> 'The value of our variable is put first on to the defining line'

code in the top half of the ZX-81 screen and a console, immediate access, screen in the bottom half into which you can type words for immediate compilation. The editor will enable you to save both lines and whole screens of definitions.

The ROM is Fig-Forth standard but some changes have been made to make it more memory-efficient. The user will have none of the difficulties inherent in the other cassette-based packages which are available for the Spectrum and ZX-81. SAVEing both screens and dictionaries is easy and, because of the full-screen editor, word definition could not be much easier.

If that was not sufficient the package will also perform multi-tasking, which means that the machine will seem to do several things at the same time.

Those who own Spectrums may feel overlooked but a Spectrum ROM cartridge is on the way.

For more information about both devices, you can write to David Husband, 2 Gorlestone Road, Branksome, Poole, BH1 NW. He can also be reached on the telephone between the hours of 7pm and 8pm on 0202 764724 from Monday to Saturday.

Users of the more usual cassette-based packages will be pleased to learn that companies producing them are thinking about implementing microwave storage commands in the language.

That will give the language some kind of comparison with the disc-based Forth compilers on bigger machines and it will also deal with criticisms voiced about the limited use of Forth on a microcomputer because of storage problems.

Next month I will look in more detail at the Forth ROM and delve further into data structures.



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PROGRAM PRINTOUT

Instructions for graphics characters are printed in lower-case letters in our listings. They are enclosed by brackets and separated by colons to distinguish them and the brackets and colons should not be entered.

Inverse characters are represented by the letter "i" and graphics characters by "g". Thus an inverse W would be represented by "iw", a graphics W by "gw", and an inverse graphics W by "igw".

Spaces are represented by "sp" and inverse spaces by "isp". Whenever any character is to be used more than once, the number of times it is to be used is shown before it, together with a multiplication sign. This "6*isp" means six inverse spaces and "(g4:4*i4:g3) would be entered as a graphic four, followed by an inverse four repeated four times, followed by a graphics three.

Where whole words are to be written in inverse letters they appear in the listings as lower-case letters. Letters to be entered in graphics mode on the Spectrum are underlined.

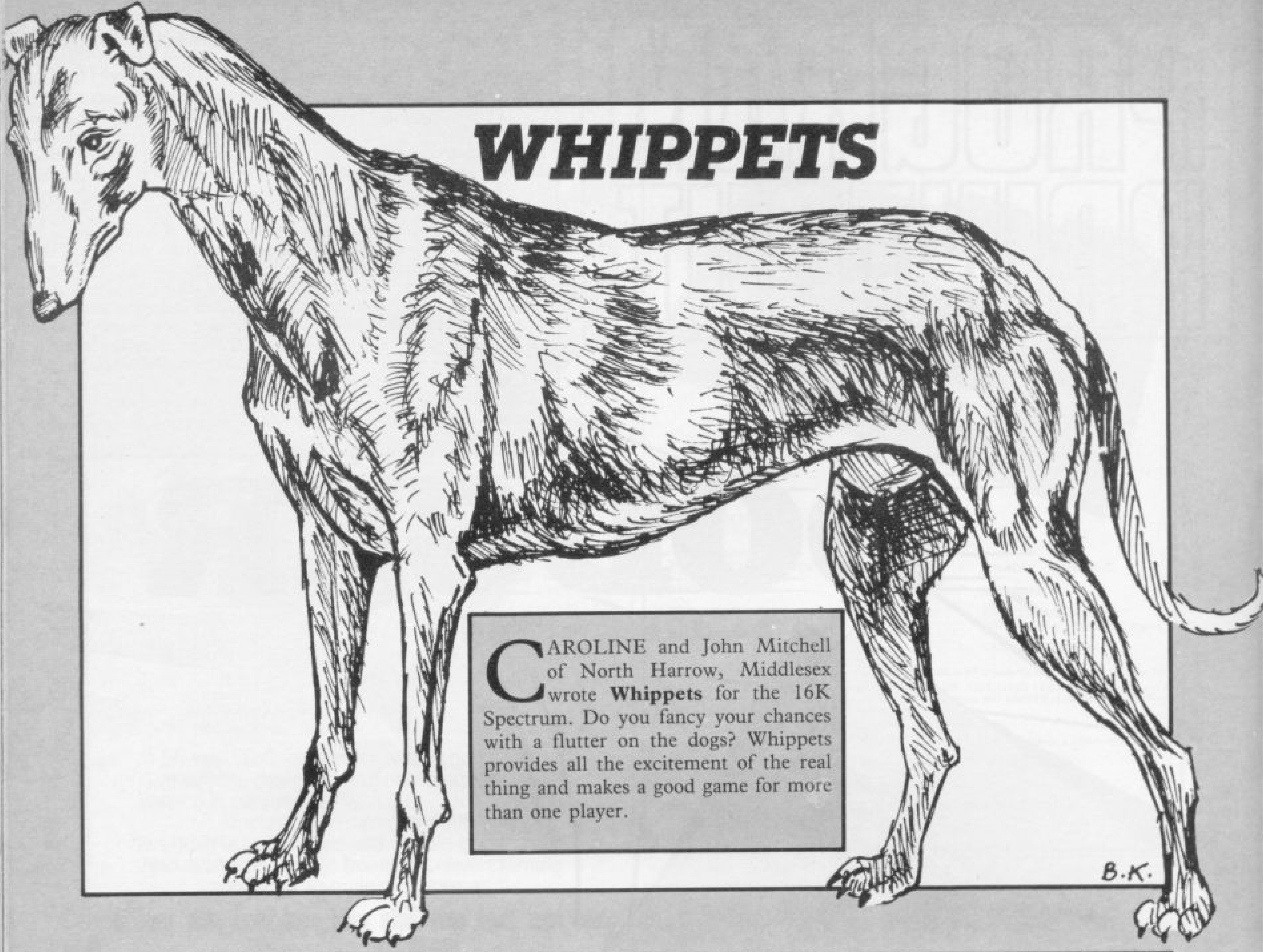
Inverse characters may be entered on the ZX-81 by changing to graphics mode and then typing the appropriate characters and on the Spectrum by changing to inverse video and typing the appropriate letters. Graphics characters may be entered on the ZX-81 by changing to graphics mode and then pressing symbol shift while the appropriate characters are entered. On the Spectrum graphics characters may be obtained by changing to graphics mode and then pressing the appropriate character. User-defined graphics will appear as normal letters until the program has been RUN.

DODGER

P HAWKINS of Exeter wrote **Dodger** for 1K ZX-81. Dodge the ghost "Z" with the cursor keys and eat as many black squares as you can. The ghost can move faster than you but cannot move through black squares. After listing the program type-in these POKE statements and press new line after each:

POKE 16514,1
POKE 16515,0
POKE 16516,0
POKE 16517,42
POKE 16518,14
POKE 16519,64
POKE 16520,78
POKE 16521,201

```
 10 REM ......
 15 LET S=CODE ""
 20 FOR N=CODE "" TO  CODE "2"
 30 PRINT AT RND*CODE "(9s)",RN
D*CODE "(9s)";"(isp)"
 40 NEXT N
 50 LET A=CODE ""
 60 LET B=A
 70 LET Y=CODE "(9s)"
 80 LET X=Y
 85 LET Z=153
 90 LET Q=Y
 100 LET P=X
 110 LET A=A+(INKEY$="8")-(INKEY
$="5")
 120 LET B=B+(INKEY$="6")-(INKEY
$="7")
 130 PRINT AT B,A;
 135 IF USR 16514=128 THEN LET S
=S+1
 137 PRINT "*"
 138 PRINT AT Y,X;" "
 140 LET L=INT (RND*2)+1
 150 GOTO L+150
 151 LET X=X+SGN (A-X)
 152 GOTO Z
 153 LET Y=Y+SGN (B-Y)
 160 PRINT AT Y,X;
 170 IF USR 16514=128 THEN GOTO
400
 180 IF Y=B AND X=A THEN GOTO 50
0
 190 PRINT "Z"
 200 PRINT AT B,A;" "
 210 GOTO 85
 400 LET X=P
 410 LET Y=Q
 420 PRINT AT B,A;" "
 430 PRINT AT Y,X;"Z"
 440 LET Z=160
 450 GOTO 90
 500 PRINT "GAME OVER";S
```



WHIPPETS

CAROLINE and John Mitchell of North Harrow, Middlesex wrote **Whippets** for the 16K Spectrum. Do you fancy your chances with a flutter on the dogs? Whippets provides all the excitement of the real thing and makes a good game for more than one player.

```
 60 CLS
 70 GO SUB 1300
 110 RANDOMIZE
 120 GO SUB 1500
 130 PRINT AT 7,0;"here are the
odds on each runner"
 140 PRINT AT 9,0; INVERSE 1;"ru
nner odds     punter        bet  "
 150 FOR o=1 TO 6
 160 PRINT  INK (7-o);AT 10+o,3;
o;AT 10+o,7;p(o);":";q(o)
 170 NEXT o
 210 DIM m$(6,10): DIM b(6)
 220 FOR i=1 TO 6
 230 PRINT AT 18,0;"do you wish
to bet on "; FLASH 1; INK (7-i);
"runner ";i; FLASH 0; INK 0;" ?"
 240 BEEP 0.25,0: INPUT  INVERSE
 1;"enter y or n : ";a$
 250  IF a$="n" THEN  GO TO 300
 260 IF a$<>"y" THEN  GO TO 240
 270 INPUT "enter your name : ";
m$(i): PRINT  INK (7-i);AT 10+i,
15;m$(i)
 280 INPUT "place your bet ( up
to `1000 ) : `";b(i): PRINT  INK
(7-i);AT 10+i,27;"`";b(i)
 290 GO TO 310
 300 LET m$(i)="no punter": PRIN
T  INK (7-i);AT 10+i,15;m$(i);AT
 10+i,25;"no bet"
 310 NEXT i
 320 PRINT AT 18,0;"now you can
go to the race track": BEEP 1,0
 330 PRINT AT 20,0;"by pressing
any letter key"
 340 IF INKEY$="" THEN  GO TO 33
0
 410 CLS : PRINT  INVERSE 1;"pun
ter";AT 0,9;"runner";AT 0,17;"od
ds";AT 0,23;"bet"
 420 FOR j=1 TO 6
 430 PRINT  INK 7-j;AT j,0;m$(j)
;AT j,12;j;AT j,17;p(j);":";q(j)
;AT j,23;"£";b(j)
 440 NEXT j
 510 FOR i=1 TO 6
 520 PRINT AT 8+2*(6-i),0; INVER
SE 1; INK i;7-i
 530 GO SUB 2000: PRINT  INVERSE
 1;AT 9+2*(i-1),0; INK 7-i;"  (g
t:gh)"
```

```
 540 NEXT i
 550 PRINT AT 0,31;"!";AT 1,31;"
W";AT 2,31;"I";AT 3,31;"N";AT 4,
31;"N";AT 5,31;"E";AT 6,31;"R";A
T 7,31;"!"
 610 PRINT  INVERSE 1;AT 12,6;"p
ress any letter key";AT 15,6;" t
o start this race "
 620 IF INKEY$="" THEN  GO TO 60
0
 630 PRINT AT 12,6;"
          ";AT 15,6;"
          "
 640 DIM r(6)
 650 LET k=INT (RND*6+1)
 660 GO SUB 2000: PRINT AT 9+2*(
k-1),r(k); INK (7-k);"  (gt:gh)"
 670 LET r(k)=r(k)+1
 680 GO SUB 2500: PRINT  INK (7-
k);AT 9+2*(k-1),r(k);"  (gr:gf)"
 690 IF r(k)<28 THEN  GO TO 650
 710 GO SUB 2000: PRINT AT 9+2*(
k-1),30; FLASH 1; INK (7-k);"(gt
:gh)"
 720 PRINT AT 8+2*(k-1),31;"!";A
T 10+2*(k-1),31;"!"
 730 PAUSE 50: BEEP 1,0
 740 PRINT AT 8+2*(k-1),4;"to co
llect your winnings";AT 9+2*(k-1
),6;"press any letter key"
 750 IF INKEY$="" THEN  GO TO 74
0
 800 REM winnings routine
 810 CLS
 820 PRINT AT 2,0; INK (7-k);"wh
ippet number ";k;" won this race
"830 PAUSE 25: IF b(k)=0 THEN  G
O TO 900
 840 PRINT AT 5,0;"you chose thi
s one "; INK (7-k);m$(k)
 850 PRINT AT 7,0;"your bet was
"; INK (7-k);"£";b(k); INK 0;" a
t "; INK (7-k);p(k);":";q(k); IN
K 0;" to win"
 860  PRINT AT 9,0;"so you colle
ct "; INK (7-k);"£";INT (100*b(k
)*p(k)/q(k)+0.5)/100
 870 PRINT AT 12,0;"( sorry ever
y one else !"''"you all lose you
r bets )"
 880 GO TO 950
 900 PRINT AT 8,0;"no punter bet
 on this runner"
 910 PAUSE 25: PRINT AT 10,0;"so
rry ! you all lose your bets !"
 950 PAUSE 50: BEEP 1,0: REM fin
ishing routine
 960 PRINT AT 18,0; INVERSE 1;"p
ress letter key R to race again"
''"press letter key F to finish"
 970 IF INKEY$="r" THEN  GO TO 1
0
 980 IF INKEY$<>"f" THEN  GO TO
960
 990 NEW
1310 FOR l=0 TO 7
1320 INK (7-l): PAPER 1
1330 PRINT AT 1,6;"(isp:18*sp:is
p)"
1340 PRINT AT 2,6;"(isp: SIX WHI
PPETS RUN: isp)"
1350 PRINT AT 3,6;"(isp:18*sp:is
p)"
1360 PRINT AT 4,6;"(isp: WHICH W
ILL WIN ?: isp)"
1370 PRINT AT 5,6;"(isp:18*sp:is
p)"
1380 PAUSE 25
1390 NEXT l
1400 RETURN
1510 DIM p(6): DIM q(6)
1520 FOR o=1 TO 6
1530 LET p(o)=INT (RND*9+1)
1540 LET q(o)=INT (RND*9+1)
1550 NEXT o
1560 RETURN
2110 POKE USR "T"+0,BIN 11000000
2120 POKE USR "T"+1,BIN 00110000
2130 POKE USR "T"+2,BIN 00001111
2140 POKE USR "T"+3,BIN 00000111
2150 POKE USR "T"+4,BIN 00111011
2160 POKE USR "T"+5,BIN 01000000
2170 POKE USR "T"+6,BIN 10000000
2180 POKE USR "T"+7,BIN 00000000
2210 POKE USR "H"+0,BIN 00001100
2220 POKE USR "H"+1,BIN 00011110
2230 POKE USR "H"+2,BIN 11110000
2240 POKE USR "H"+3,BIN 11100000
2250 POKE USR "H"+4,BIN 11011100
2260 POKE USR "H"+5,BIN 00000010
2270 POKE USR "H"+6,BIN 00000001
2280 POKE USR "H"+7,BIN 00000000
2300 RETURN
2610 POKE USR "R"+0,BIN 00100000
2620 POKE USR "R"+1,BIN 00100000
2630 POKE USR "R"+2,BIN 00111111
2640 POKE USR "R"+3,BIN 00000111
2650 POKE USR "R"+4,BIN 00001011
2660 POKE USR "R"+5,BIN 00001000
2670 POKE USR "R"+6,BIN 00001000
2680 POKE USR "R"+7,BIN 00000110
2710 POKE USR "F"+0,BIN 00001100
2720 POKE USR "F"+1,BIN 00011110
2730 POKE USR "F"+2,BIN 11110000
2740 POKE USR "F"+3,BIN 11100000
2750 POKE USR "F"+4,BIN 11010000
2760 POKE USR "F"+5,BIN 00010000
2770 POKE USR "F"+6,BIN 00010000
2780 POKE USR "F"+7,BIN 01100000
2800 RETURN
```

ZOMBIE ISLAND

YOU HAVE been shipwrecked on an island inhabited by semi-human zombies. You must evade them and destroy them by luring them into the sea round the island, or into the graves with which the island is dotted.

Move using the usual cursor keys. When the program begins a map of the island will be displayed for a short time before the instructions appear.

Zombie Island was written for the 16K ZX-81 by Guy Gratton of High Wycombe, Buckinghamshire.

```
   2 POKE 16510,0
   3 CLS
   4 LET S=0
   5 POKE 16418,0
   9 GOSUB 2000
  10 REM ******ISLAND******
  20 DIM A$(23,31)
  30 PRINT "          ZOMBIE ISLAN
D"
  40 FOR A=1 TO 31
  50 LET A$(1,A)="(9h)"
  60 LET A$(23,A)="(9h)"
  70 NEXT A

                    80 LET A$(2)="
(18*9h 8*isP 5*9 h)"
  90 LET A$(3)="(8*9h 20*isP 3*9
h)"
 100 LET A$(4)="(7*9h 22*isP 2*9
h)"
 110 LET A$(5)="(5*9h 25*isP 9h)
"
 120 LET A$(6)=A$(5)
 130 LET A$(7)=A$(6)
 135 LET A$(7,5)="(isP )"
 140 FOR A=8 TO 10
 150 LET A$(A)=A$(7)
 160 NEXT A
 170 LET A$(11)=A$(7)
 175 LET A$(11,4)="(isP )"
 180 FOR A=12 TO 15
 190 LET A$(A)=A$(11)
 200 NEXT A


 210 LET A$(16)=& 210 LET A$(16)
="(4*9h 25*isP 2* 9h)"
 220 LET A$(17)=A$(16)
 230 LET A$(18)=A$(17)
 235 LET A$(18,3)="(9h)"
 240 LET A$(19)=A$(18)
 245 LET A$(19,29)="(9h)"
 250 LET A$(20)="(5*9h 18*isP 8*
9h)"
 260 LET A$(21)="(5*9h 18*isP 8*
9h)"
 270 LET A$(22)="(12*9h 7*isP 12
*9h)"
 280 REM **POTHOLES**
 290 FOR A=-5 TO RND*15
 300 LET X=INT (RND*21)+1
 310 LET Y=INT (RND*30)+1
 311 LET Z=INT (RND*4)
 312 IF Z=0 THEN LET G$="(95)"
 313 IF Z=1 THEN LET G$="(96)"
 314 IF Z=2 THEN LET G$="(97)"
 315 IF Z=3 THEN LET G$="(98)"

 320 IF A$(X,Y)="(isP )" THEN LET
 A$(X,Y)=G$
 330 NEXT A
 340 FOR A=1 TO 23
 350 PRINT TAB (1);A$(A)
 360 NEXT A
 370 LET A=INT (RND*22)+1
 380 LET B=INT (RND*30)+1
 390 IF A$(A,B)<>"(isP )" THEN GO
TO 370
 400 REM ******ZOMBIES******
 410 LET NO OF ZOMBIES =INT (RND
*7)+1
 420 DIM X(NO OF ZOMBIES)
 430 DIM Y(NO OF ZOMBIES)
 440 FOR Z=1 TO NO OF ZOMBIES


 450 LET X=INT (RND*21)+1
 460 LET Y=INT (RND*29)+1
 470 IF A$(X,Y)="(9h)" THEN GOTO
 450
 480 LET X(Z)=X
 490 LET Y(Z)=Y
 500 NEXT Z
 600 REM ******GAME******
 601 IF INKEY$<>"S" THEN GOTO 61
0
 602 SAVE "ZOMBIEs"
 603 PAUSE 500
 604 CLS
 605 RUN
 610 REM move zombies
 611 IF RND>.3 THEN GOTO 620
 612 PRINT AT A,B;"(isP)"
 614 LET A=A+(INKEY$="6")-(INKEY
$="7")
 616 LET B=B+(INKEY$="8")-(INKEY
$="5")
 618 PRINT AT A,B;"(INVX)"


 620 FOR Z=1 TO NO OF ZOMBIES
 630 IF X(Z)=1000 THEN GOTO 700
 640 PRINT AT X(Z),Y(Z);"(ISP)"
 650 LET X(Z)=X(Z)+(X(Z)<A)-(X(Z
)>A)
 660 LET Y(Z)=Y(Z)+(Y(Z)<B)-(Y(Z
)>B)
 661 PRINT AT X(Z),Y(Z);""""
 662 IF X(Z)=A AND Y(Z)=B THEN G
OTO 664
 663 GOTO 675
 664 PAUSE 100
 665 CLS
 666 PRINT "YOU GOT MUNCHED BY A
 ZOMBIE"
 667 GOTO 820
 675 IF A$(X(Z),Y(Z))="(ISP)" TH
EN GOTO 700
 680 LET S=S+50
 687 PRINT AT 1,1;"SPLASH GOES A
 ZOMBIE"
 688 PAUSE 100

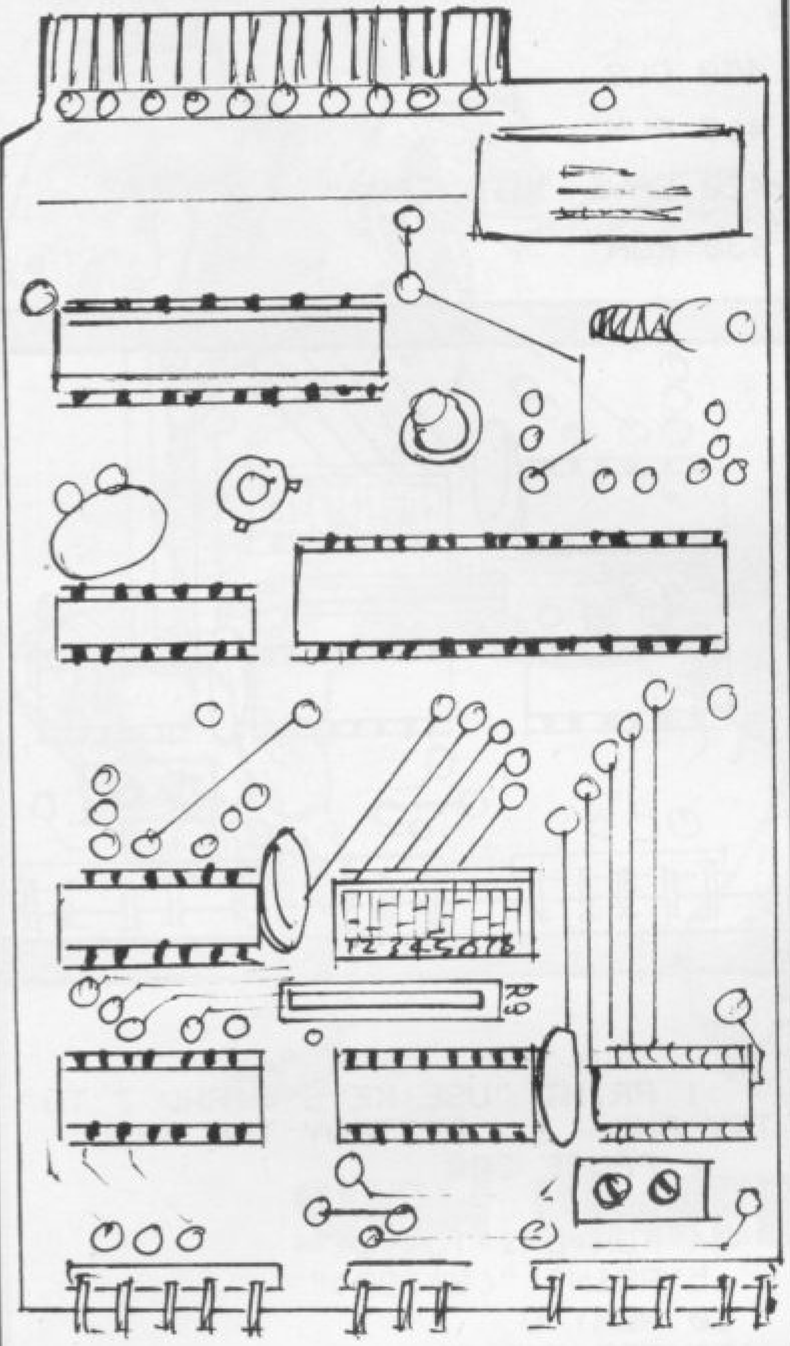

 689~PRINT AT 1,1;A$(1)
 690 PRINT AT X(Z),Y(Z);A$(X(Z),
Y(Z))
 695 LET X(Z)=1000
 700 NEXT Z
 710 LET S=S+1
 720 REM move Player
 730 PRINT AT A,B;"(ISP)"
 740 LET A=A+(INKEY$="6")-(INKEY
$="7")
 750 LET B=B+(INKEY$="8")-(INKEY
$="5")
 760 PRINT AT A,B;"(INVX)"
 770 IF A$(A,B)="(ISP)" THEN GOT
O 900
 780 PAUSE 100
 790 CLS
 800 IF A$(A,B)="(9h)" THEN PRIN
T "YOU FELL OF THE ISLAND"


 810 IF A$(A,B)<>"(9h)" THEN PRI
NT "YOU FELL IN A GRAVE AND ARE
NOW DESTINED TO HAUNT zombie isl
and         FOREVER"
 820 PRINT ,,,,"   YOU SCORED ";
S
 830 PRINT ,,,,,,,,,,"try again (
Y/N)"
 840 PAUSE 4E4
 850 IF INKEY$="Y" THEN RUN
 860 IF INKEY$="N" THEN NEW
 870 GOTO 840
 905 LET H=0
 910 FOR Z=1 TO NO OF ZOMBIES
 920 IF X(Z)=1000 THEN LET H=H+1
 930 NEXT Z
 940 IF H<>NO OF ZOMBIES  THEN G
OTO 1000
 950 PAUSE 100

 960 PRINT "WELL DONE YOU GOT TH
E LOT BUT   HERE COMES SOME MORE
"
 970 PRINT AT 10,1;"Press a key"
 980 PAUSE 4E4
 985 CLS
 990 GOTO 10
1500 GOTO 600
2010 CLS
2020 PRINT "WELCOME TO...",,,,TA
B 7;"ZOMBIE ISLAND";TAB 6;"(14*9
s)"
2030 PRINT ,,,,TAB 3;"YOU HAVE J
UST BEEN SHIPWECKED"
2040 PRINT "ON THE LEDGENDARY ZO
MBIE ISLAND"
2060 PRINT "HERE TO SAVE YOUR SO
UL YOU MUST"
2070 PRINT "DESTROY THESE VILE C
REATURES BY"
2080 PRINT "EITHER LURING THEM T
O THEIR DOOM"

2090 PRINT "IN THE SEA or BY TRA
PPING THEM"
2100 PRINT "IN THE ISLANDS MANY
GRAVES"
2110 PRINT ,,,,TAB 5;"YOU CAN MO
VE USING..."
2120 PRINT TAB 15;"7";TAB 14;"5(
9h)8";TAB 15;"6"
2130 PRINT AT 23,3;"Press a key
to begin"
2140 PAUSE 4E4
2150 CLS
2160 RETURN
```

CIRCUIT

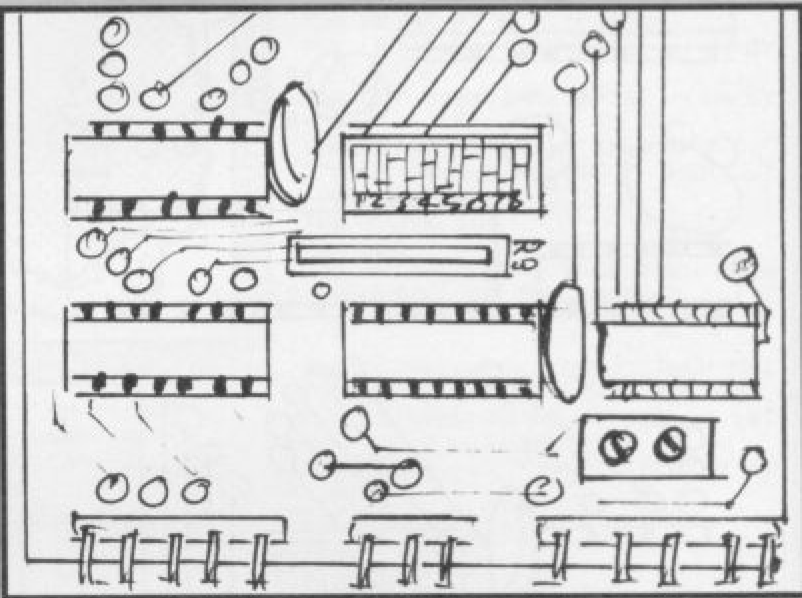


YOU ARE an **Electric Current** running round a circuit board. Go up with 1, down with A, right with P and left with I. After the game your circuit time is given.

The program was written by D Pih, aged 12, of Ellesmere Port, Cheshire for the 16K ZX-81.

```
2 LET S=0
5 LET T=0
10 PRINT "(21*9h)"
20 PRINT "(9h)*.................*(9h)"
30 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
40 PRINT "'40 PRINT "(9h).(2*9h).(2*9h).( 2*9h).(2*9h).(2*9h).(2*9h).(9h)"
50 PRINT "(9h)..................(9h)"
60 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
70 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
80 PRINT "(9h)..................(9h)"
90 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
100 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
110 PRINT "(9h)..................(9h)"
120 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
130 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
140 PRINT "(9h)..................(9h)"
150 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
160 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
170 PRINT "(9h)..................(9h)"
180 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
190 PRINT "(9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(2*9h).(9h)"
```

```
 200 PRINT "(9h)*...............
..*(9h)"
 210 PRINT "(20*9h)"
 220 LET B=10
 230 LET A=10
 235 PRINT AT B,A;"o";AT B,A;" "
 240 LET B=B+(INKEY$="A")-(INKEY
$="1")
 250 LET A=A+(INKEY$="P")-(INKEY
$="I")
 251 LET T=T+.5
 255 PRINT AT 0,1;"SCORE ";S
 260 LET A$=CHR$ PEEK (PEEK 1639
6+256*PEEK 16397+1+A+(B*33))
 270 IF A$="(9h)" THEN GOTO 380
 280 IF A$="." THEN LET S=S+1
 290 IF A$="*" THEN LET S=S+5
 300 IF S=231 OR S>231 THEN GOTO
 380
 310 GOTO 235
 350 CLS
 360 RUN
 380 PRINT AT 0,10;"TIME ";T
 390 IF INKEY$<>"R" THEN GOTO 39
0
 400 CLS
 410 RUN
 420 SAVE "BIG TRAP"
 430 RUN
```

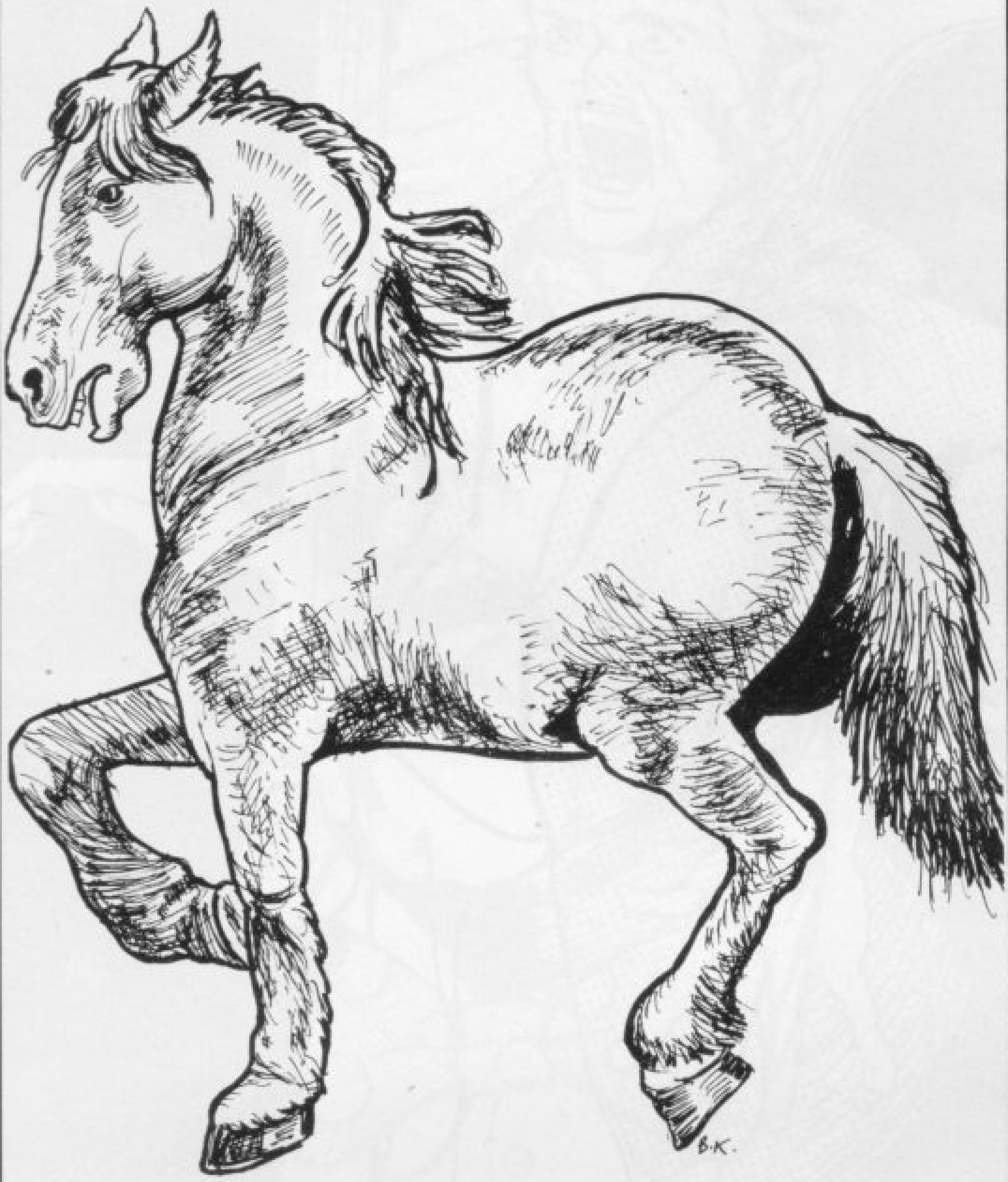


BARS



ASHLEY MORRIS, aged 12, of Waltham, Grimsby wrote **Bars** for the 1K ZX—81. He has had his ZX-81 only a few weeks and this is his first program. Try and break down the wall into bars by steering into it with keys 6 and 7.

```
   1 PRINT "USE KEYS 6 AND 7 TO
TRY AND        DESTROY THE WALL"
   2 PAUSE 200
   3 CLS
   4 FOR O=1 TO 10
   5~PRINT "(8*ISP)"
  10 NEXT O
 155 FOR M=0 TO 20
 160 LET A=60
 171 LET B=30
 175 FOR N=31 TO 2 STEP -1.5
 180 PLOT A,B
 190 LET A$=INKEY$
 195 UNPLOT A,B
 197 PLOT A,B
 198 UNPLOT A,B
 199 IF M=20 THEN GOTO 250
 200 IF A$="7" THEN LET B=B+1
 205 IF A$="6" THEN LET B=B-1
 220 LET A=A-3
 230 NEXT N
 240 NEXT M
 250~PRINT AT 11,16;"not very fa
st"
```



SHOW JUMPER

TACKLE THE JUMPS in **Showjumper** by Carl Kropacz for the 16K Spectrum. You collect faults if you do not jump properly. Improve your score or go to a higher level.

```
   5 POKE 23609,50
   7 LET hs=40: LET d$="Nimble N
ed"
  10 BORDER 2: PAPER 2: CLS
  20 FOR n=USR "a" TO USR "c"+7:
 READ x: POKE n,x: NEXT n
  30 DATA 0,16,24,26,63,124,164,
36,0,72,108,120,52,100,64,64,0,8
,12,60,90,79,4,4
  35 LET t=0
  37 GO SUB 430
  40 BEEP .5,20: PRINT AT 5,0; I
NK 1;"(inv93:93:inv93:93:inv93:9
3:inv93:93:inv93:93)"; INK 7;"SH
OW JUMPING"; INK 1;"(inv93:93:in
v93:93:inv93:93:inv93:93:inv93)"
  50 INPUT "What speed? (1-5)  "
;s: IF s<0 OR s>5 THEN  FOR f=1
TO 15: BEEP .05,10: BORDER 0: BE
EP .05,20: BORDER 2: NEXT f: GO
TO 50
  60 PRINT AT 10,12; INK 0;"Leve
l=";s;AT 15,10; INK 7;"Press ~7~
 to jump";AT 17,10;"Press ~s~ to
 save"
  70 PAUSE 80
  75 BEEP .5,10
  80 CLS
  90 FOR j=4 TO 20 STEP 4: FOR y
=0 TO 31
 100 PRINT AT j,y; INK 4;"(inv93
)"
 110 NEXT y: NEXT j
 120 INK 4: PRINT AT 3,j1;"(95)"
;AT 7,j2;"(95)";AT 7,j3;"(95)";A
T 11,j4;"(95)";AT 11,j5;"(95)";A
T 15,j6;"(95)";AT 15,j7;"(95)";A
T 19,j8;"(95)";AT 19,j9;"(95)";A
T 19,j10;"(95)"
 130 INK 0: PRINT AT 0,0;"Curren
t leader=";d$;' ;hs;" faults"
 140 LET n=1: LET a=3
 145 GO SUB 220
 150 PRINT AT a,n-1;" ": PRINT A
T a,n;"(9a)": BEEP .002,0
 160 IF INKEY$="7" THEN  GO SUB
330
 165 IF INKEY$="s" THEN  GO SUB
480
 170 LET n=n+1
 180 FOR f=1 TO 10*s-10: NEXT f
 190 IF n=32 THEN  LET n=1: LET
a=a+4: PRINT AT a-4,n+30;" "
 200 IF a=23 THEN  GO TO 350
 210 GO TO 145
 220 IF a=3 AND n=j1 THEN  GO TO
 340
 230 IF a=7 AND n=j2 THEN  GO TO
 340
 240 IF a=7 AND n=j3 THEN  GO TO
 340
 250 IF a=11 AND n=j4 THEN  GO T
O 340
 260 IF a=11 AND n=j5 THEN  GO T
O 340
 270 IF a=15 AND n=j6 THEN  GO T
O 340
 280 IF a=15 AND n=j7 THEN  GO T
O 340
 290 IF a=19 AND n=j8 THEN  GO T
O 340
 300 IF a=19 AND n=j9 THEN  GO T
O 340
 310 IF a=19 AND n=j10 THEN  GO
TO 340
 320 RETURN
 330 PRINT AT a,n;"(9b)": FOR f=
1 TO 10*s: NEXT f: LET a=a-1: LE
T n=n+1: PRINT AT a+1,n-1;" ": G
O SUB 440: PRINT AT a,n;"(9a)":
FOR f=1 TO 10*s: NEXT f: LET a=a
+1: LET n=n+1: PRINT AT a-1,n-1;
" ": GO SUB 440: PRINT AT a,n;"(
9a)": GO TO 220
 340 PRINT AT a,n-1;" ": LET n=n
+1: PRINT AT a,n-1; INK 4;"(93)"
;AT a,n;"(9a)";AT a,n;" ": LET n
=n+1: LET t=t+4: RETURN
 350 PAUSE 50
 360 IF t=0 THEN  BEEP .5,10: PR
INT AT 9,0;"Well done you had a
clear round": GO TO 375
 370 BEEP .5,0: PRINT AT 9,0;"Ha
rd luck you had ";t;" faults"
 375 PAUSE 40
 380 IF t<hs THEN  BEEP .5,20: P
RINT AT 13,0;"You have got today
s best round": INPUT "Enter hors
es name";d$: LET hs=t
 390 BEEP .5,10: PRINT AT 17,2;
INK 1; PAPER 6; FLASH 1;"Do you
want another game (y/n)"
 400 IF INKEY$="n" THEN  STOP
 410 IF INKEY$="y" THEN  CLS : G
O TO 35
 420 GO TO 400
 430 LET j1=11+INT (RND*15): LET
 j2=6+INT (RND*8): LET j3=10+INT
 (RND*8): LET j4=6+INT (RND*8):
LET j5=10+INT (RND*8): LET j6=6+
INT (RND*8): LET j7=18+INT (RND*
8): LET j8=10+INT (RND*5): LET j
9=j8+3+INT (RND*3): LET j10=j9+3
+INT (RND*3): RETURN
 440 IF n=32 THEN  LET n=1: LET
a=a+4
 450 IF a=23 THEN  GO TO 350
 470 RETURN
 480 SAVE "horse" LINE 5: VERIFY
 ""
 490 RETURN
```

SEED CATCHER



CATCH THE SEEDS in your basket before they spoil your crop. You can manage to carry only 10 at once, so you have to drop them quickly and return to your task.

Seed Catcher was written by K Brown of Codnor, Derbyshire, for the 16K Spectrum.

```
   1 BRIGHT 0: CLS : GO SUB 9300
 : GO SUB 9000
   2 LET score=0: PRINT "you sco
red";score: LET see=0: PAUSE 100
   5 LET score=0: LET bonus=1000
 : LET man=10
   6 LET seed=INT (RND*31)
   7 LET n=2
   8 LET time=1000
  10 BORDER 4: PAPER 4: INK 2: C
LS
  14 FOR z=0 TO 1
  15 DATA 10,12,14,10,17,19,17,1
6,14,13,14,16,14,4
  20 FOR a=1 TO 14: READ c: BEE
P .02,c: BEEP .02,-c+17: BEEP .0
1,c: BEEP .01,-c+17: BEEP .01,c:
 NEXT a: BEEP .01,-c+17: BEEP .0
1,-c+17
  21 RESTORE : PAUSE 27: NEXT z
 100 PRINT AT 0,0;"Score=";score
;AT 0,11;"BONUS:";bonus
 101 IF n>=20 THEN  LET seed=INT
 (RND*31)
 102 PRINT AT 0,23;"SEEDS=";see
 103 PRINT AT 1,10; FLASH 1; INK
 0;"TIME:";INT time
 104 LET time=time-1
 105 IF see>=10 THEN  LET see=10
 : BEEP .01,INT (RND*10)
 110 LET bonus=bonus-1
 111 IF time<=0 THEN  GO TO 9998
 120 PRINT AT 21,man; INK 0;" (9
m) ";AT 20,man; INK 0;" (9a) "
 200 IF INKEY$="z" THEN  LET man
=man-1
 210 IF INKEY$="x" THEN  LET man
=man+1
 220 IF man>=29 THEN  LET man=29
 230 IF man<=0 THEN  LET man=0
 300 PRINT AT n,seed; INK 6;"(9s
)": PRINT AT 20,seed;" "
 310 PRINT AT n-1,0;"
                   ": LET n=n+
1: IF n=21 THEN  LET n=2
 350 PRINT AT 20,seed;" "
 400 IF man+1=seed AND n=20 THEN
  LET score=score+10: BEEP .01,4
0: BEEP .01,30: BEEP .01,20: BEE
P .01,10: BEEP .01,0: LET see=se
e+1: BEEP .01,5
 500 PRINT AT 21,0;"(_)"
 550 IF man=1 AND see=10 THEN  F
OR z=0 TO 10: BEEP .01,z: NEXT z
 : LET score=score+bonus: LET see
=0
8000 GO TO 100
9000 BORDER 4: PAPER 4: INK 7: C
LS
9010 PAPER 7: CLS : PRINT AT 0,0
; FLASH 1; PAPER 1;"    S E E D
  C A T C H E R     "
9030 LET a$=                    "
You (9a) have to move from left
to     (9m)
      right trying to catch as m
any
      seeds (9s) as you can befo
re your
          time runs out.When you
have
          collected 10 seeds you
have to
          go and put them in the
tray at
          the side of the screen
and then
          go and collect anoher 1
0.For
          every seed you catch yo
u get 10
             Points"
9035 LET b$="USE KEYS-
             Z TO GO LEFT
             X TO GO RIGHT"
9040 BRIGHT 1: FOR a=1 TO 583: L
ET ink=INT (RND*4): PRINT  INK i
nk;a$(a);: NEXT a
9045 BRIGHT 0: FOR a=1 TO 77: LE
T ink=INT (RND*4): PRINT  INK in
k;b$(a);: NEXT a: BRIGHT 1
9050 PRINT £1;"GOOD LUCK.Press a
ny key to start"
9060 PAUSE 0
9070 RETURN
9200 LOAD ""CODE : RUN
9300 POKE USR "a"+0,BIN 00000000
9310 POKE USR "a"+1,BIN 00000000
9320 POKE USR "a"+2,BIN 00000000
9330 POKE USR "a"+3,BIN 00000000
9340 POKE USR "a"+4,BIN 00011000
9350 POKE USR "a"+5,BIN 01111110
9360 POKE USR "a"+6,BIN 00111100
9370 POKE USR "a"+7,BIN 00111100
9410 POKE USR "m"+1,BIN 00011000
9420 POKE USR "m"+2,BIN 01111110
9430 POKE USR "m"+3,BIN 01011010
9440 POKE USR "m"+4,BIN 01011010
9450 POKE USR "m"+5,BIN 00011000
9460 POKE USR "m"+6,BIN 00100100
9470 POKE USR "m"+7,BIN 00100100
9500 POKE USR "s"+0,BIN 00000000
9510 POKE USR "s"+1,BIN 00000000
9520 POKE USR "s"+2,BIN 00011000
9530 POKE USR "s"+3,BIN 00111100
9540 POKE USR "s"+4,BIN 00111100
9550 POKE USR "s"+5,BIN 00111100
9560 POKE USR "s"+6,BIN 00111100
9570 POKE USR "s"+7,BIN 00011000
9600 RETURN
9998 PRINT AT 10,10; FLASH 1; IN
K 0;"GAME OVER": PAUSE 0: PAUSE
0
9999 GO TO 2
```

PSYCHIATRIST



MICHAEL HOPKINS wrote **Psychiatrist** for the 16K Spectrum. The program tests how well you can recognise numbers. A number of up to six digits flashes on the screen and you have to enter the number you see. The time limit on the screen diminishes steadily. At the end, the overall results are analysed.

```
   1 REM "spot nos "
   2 CLS : POKE 23658,8: POKE 23
609,50: BURDER 5: PAPER 7
   5 PRINT  INK 2; FLASH 1;AT 0,
7;"SPOT THE NUMBERS.": PRINT  IN
K 1;"(7*sp:17*INVg3)": INK0

  10 PRINT '"THIS PROGRAM TESTS
ONE ASPECT OFNUMERACY - HOW WELL
 YOU CAN      RECOGNISE NUMBERS.

              INITIALLY A NUMBER
OF UP TO 6   DIGITS WILL FLASH O
N THE SCREEN FOR 1 SECOND.ALL YO
U HAVE TO DO IS ENTER THE NUMBER
 YOU SEE,AND YOU WILL BE TOLD IF
 IT IS RIGHT.
              THE TIME THE NUMBER
 IS ON THE    SCREEN WILL STEADIL
Y DECREASE    TO LESS THAN 1/50 S
EC. YOU WILL INEVITABLY GET SOME
 WRONG.AT THEEND YOUR OVERALL RE
SULTS WILL BESHOWN.
              PRESS ENTER TO STAR
T"
  12 IF INKEY$=CHR$ 13 THEN  CLS
 : GO TO 20
  13 IF INKEY$<>CHR$ 13 THEN  GO
 TO 12
  20 LET n=1
  30 DIM j(216): REM time
  31 DIM k(216): REM no of digit
s
  32 DIM l$(216,5)
  50 LET z=50
 110 LET a=INT (RND*7)
 150 LET x=INT (((RND*9)+1)*10↑a
)
 160 PRINT AT 10,12;x
 180 PAUSE z
 185 CLS
 190 LET z=z-1.5
 200 IF z<.5 THEN  GO TO 1000
 300 PRINT ''TAB 8;"ENTER THE NU
MBER";''TAB 12;"YOU SAW"''TAB 0;
"IF YOU FAILED TO SEE THE NUMBER
"'TAB 11;"PRESS '0'"
 302 INPUT b
 303 IF b=0 THEN  CLS : GO TO 16
0
 310 PRINT AT 10,12;b
 320 IF b=x THEN  PRINT AT 10,12
; INK 1;"O.K.    ": FOR d=0 TO 10
: BEEP .02,d: NEXT d: LET l$(n)=
"O.K.": GO TO 325
 322 PRINT AT 10,4; INK 2;"WRONG
! YOU TYPED     ";b;AT 11,4;"IT S
HOULD HAVE BEEN ";x: LET l$(n)="
WRONG": FOR d=10 TO 0 STEP -1: B
EEP .02,d: NEXT d: PAUSE 25
 325 PAUSE 75
 328 CLS
 330 LET j(n)=z: LET k(n)=a
 340 LET n=n+1
 350 GO TO 100
1000 LET g=1
1001 PRINT TAB 5;"No of";TAB 18;
"%";TAB 5;"Digits";TAB 15;"Failu
re"
1002 LET a=0
1003 LET s=0
1005 LET t=0
1008 FOR n=1 TO 200
1010 IF k(n)=g THEN  LET t=t+1:
IF l$(n)="WRONG" THEN  LET s=s+1
1020 NEXT n
1022 LET v=INT (s*100/t)
1023 LET a=a+v
1025 PRINT TAB 7;g;TAB 18;v
1030 LET g=g+1
1040 IF g>6 THEN  GO TO 1060
1050 GO TO 1003
1060 PRINT TAB 18;"--": PRINT TA
B 14;"av.";TAB 18;INT (a*100/700
): GO TO 2500
2000 POKE 23692,255: LET g=1
2002 PRINT TAB 0;"secs";TAB 10;"
No";TAB 0;"1/50";TAB 5;" of digi
ts"
2005 FOR n=1 TO 200
2007 IF j(n)<.1 THEN  LET j(n)=0
2010 IF k(n)=g THEN  PRINT TAB 0
;j(n);TAB 8;k(n);TAB 12;l$(n)
2020 NEXT n
2030 LET g=g+1: PAUSE 100: IF g>
6 THEN  GO TO 2050
2035 PRINT "   "'"    "
2040 GO TO 2002
2050 PRINT ''''''''''"DO YOU WANT
 TO TRY AGAIN? (Y/N)"
2060 IF INKEY$="Y" THEN  CLS : G
O TO 2
2070 IF INKEY$="N" THEN  GO TO 2
520
2080 GO TO 2060
2500 PRINT "   "'"   ";TAB 0;"DO Y
OU WANT TO SEE A MORE        DETA
ILED ANALYSIS? IF SO PRESS  ENTE
R"''"IF YOU WANT TO TRY AGAIN,PR
ESS A"
2510 IF INKEY$=CHR$ 13 THEN  CLS
 : GO TO 2000
2513 IF INKEY$="A" THEN  CLS : G
O TO 10
2515 GO TO 2510
2520 CLS : PRINT AT 11,11; FLASH
 1; INK 1;"GOODBYE!";AT 21,0; IN
K 2;" "
```



3 BLIND MICE

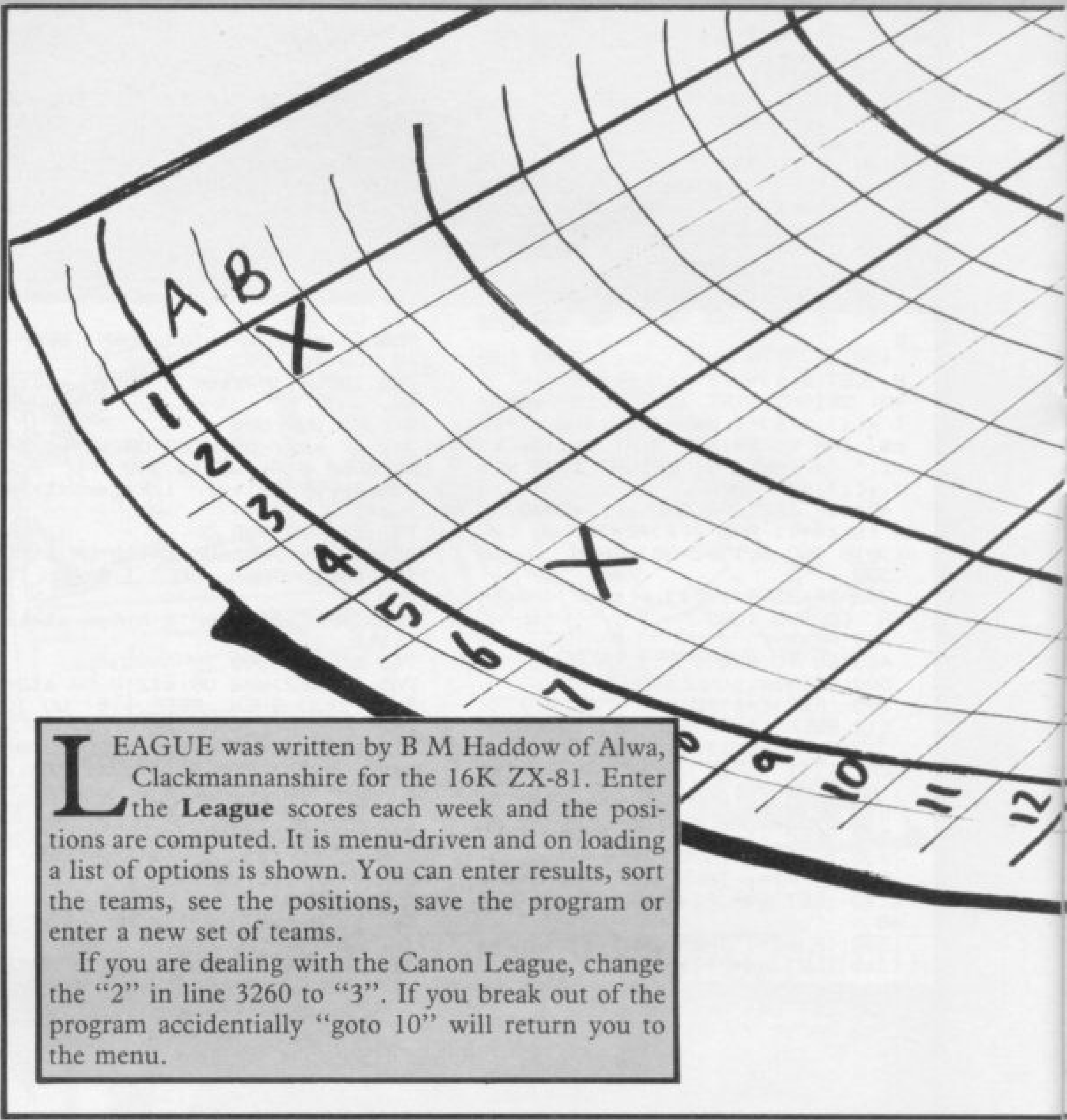
THREE BLIND MICE, by P J Wilcox of Ely, Cardiff is for the 16K Spectrum. Three mice live in the wainscoating of a house and have to sniff their way to the cheese, bumping occasionally into household objects in their path. Bets are placed on the fancied mouse in this amusing and unpredictable race for the cheese.

```
   1 RANDOMIZE
   2 PRINT AT 10,8;"JUST A MINUT
E"
   3 DEF FN a( )=INT (2+RND*5)
   5 GO SUB 9000
   6 LET mn1=10: LET mn2=10
  10 PAPER 5: BORDER 5: CLS
  20  PRINT AT 9,15;"ab";AT 11,1
0;"3 BLIND MICE": LET g=4: GO SU
B 90
  30 PRINT AT 13,15;"by": LET g=
2: GO SUB 90
  40 PRINT AT 15,10;
 : LET g=0: GO SUB 90
  50 PAUSE 30
  70 PRINT AT 19,0; FLASH 1;"Pre
ss ~y~ for instructions   -   an
y other key to play"
  75 BEEP .1,10
  78 PAUSE 0
  80 IF INKEY$="y" OR INKEY$="Y"
 THEN  GO SUB 8500
  85 GO TO 100
  90 BEEP .04,g+3: BEEP .04,g+6:
 BEEP .04,g+3: BEEP .2,g
  95 RETURN
 100 GO TO 700
 102 INK 0: PAPER 0: BORDER 0: C
LS
 105 FOR f=0 TO 31
 110 PRINT  INK 7; PAPER 2; BRIG
HT 1;AT 1,f;"r";AT 21,f;"r"; PAP
ER 0;AT 0,f;" "
 115 BEEP .01,(20-f)/3: NEXT f
 120 FOR f=2 TO 20
 125 PRINT  INK 7; PAPER 2; BRIG
HT 1;AT f,0;"r";AT f,5;"r";AT f,
31;"r"; INK 6; PAPER 0;AT f,30;"
 "
 130 BEEP .01,f/3
 135 NEXT f
 140 FOR f=3 TO 19 STEP 4: PRINT
 AT f,5; PAPER 0;" ": NEXT f
 155 PAUSE 50: GO SUB 90
 160 GO SUB 900
 161 BRIGHT 1
 165 PRINT  INK FN a( );AT x,y;"(
f:3*isP )9";AT x+1,y;"hiij"
 170 FOR f=1 TO 2
 175 GO SUB 900
 180  PRINT  INK FN a( );AT x,y;"
(f:isP )9";AT x+1,y;"hij"
 195 NEXT f
 210 FOR f=1 TO 2
 215 GO SUB 900
 220 PRINT AT x,y; INK FN a( );"n
o";AT x+1,y;"pp"
 240 NEXT f
 250 FOR f=1 TO 2
 255 GO SUB 900
 260 PRINT  INK FN a( );AT x,y;"n
go";AT x+1,y;"p p"
 275 NEXT f
 285 FOR f=1 TO INT (2+3*RND)
 290 GO SUB 920
 295 PRINT  INK FN a( );AT x,y;"k
";AT x+1,y;"m"
 315 NEXT f
 325 FOR f=1 TO INT (2+3*RND)
 330 GO SUB 920
 335 PRINT  INK FN a( );AT x,y;"l
";AT x+1,y;"m"
 350 NEXT f
 355 FOR f=1 TO INT (2+3*RND)
 360 GO SUB 920
 365 PRINT AT x,y; INK 4;"s";AT
x+1,y;"t";AT x+2,y; INK FN a( );"
u"
 375 NEXT f
 380 PRINT AT 6,30; INK 6;"n";AT
 11,30;"n";AT 16,30;"n": BEEP .2
5,20: BEEP .1,25
 385 BRIGHT 0
 390 DIM x(3): DIM y(3)
 400 LET a$="ab": LET b$="cde":
LET c$=" ab"
 402 LET x=INT (3+17*RND): LET y
=INT (3+17*RND): LET z=INT (3+17
*RND)
 405 IF ABS (x-y)<=4 OR ABS (x-z
)<=4 OR ABS (y-z)<=4 THEN  GO TO
 402
 410 LET x(1)=x: LET x(2)=y: LET
```

```
x(3)=z: LET y(1)=2: LET y(2)=2:
LET y(3)=2
 415 FOR f=1 TO 3
 420 PRINT  INK f+3; BRIGHT 1;AT
x(f),y(f);a$
 425 NEXT f
 426 GO TO 432
 430 IF (x(i)=6 AND y(i)+2=30) O
R (x(i)=11 AND y(i)+2=30) OR (x(
i)=16 AND y(i)+2=30) THEN  GO TO
 500
 432 LET i=INT (RND*3+1)
 435 FOR f=1 TO INT (RND*4+1)
 445 IF RND>.85 THEN  GO SUB 100
0
 450 IF ATTR (x(i),y(i)+2)=0 THE
N  LET y(i)=y(i)+1: PRINT  INK i
+3; BRIGHT 1;AT x(i),y(i)-1;a$;A
T x(i),y(i)-1;b$;AT x(i),y(i)-1;
c$; INK 0; BRIGHT 0;AT x(i),y(i)
-1;" "; INK i+3; BRIGHT 1;AT x(i
),y(i);a$
 451 IF (x(i)=6 AND y(i)+2=30) O
R (x(i)=11 AND y(i)+2=30) OR (x(
i)=16 AND y(i)+2=30) THEN  GO TO
 500
 452 IF ATTR (x(i),y(i)+2)<>0 TH
EN  GO SUB 1000
 455 NEXT f
 465 GO TO 430
 500  REM win
 505  FOR f=1 TO 3
 510 BEEP .1,7: BEEP .2,12: BEEP
 .1,12: BEEP .1,11: BEEP .1,9: B
EEP .1,11: BEEP .2,12: BEEP .1,7
: BEEP .2,7
 515 NEXT f
 520 BEEP .1,5: BEEP .35,4: BEEP
 .35,2: BEEP .4,0
 525 IF m1=i THEN  LET mn1=mn1+s
t1*3: LET w$="Player 1": GO TO 5
40
 530 IF m2=i THEN  LET mn2=mn2+s
t2*3: LET w$="Player 2": GO TO 5
40
 535 LET w$="Neither of you"
 540 PAPER 7: BORDER 7: CLS : PR
INT AT 10,3;"Mouse No. ";i;" (";
 INK i+3;"ab"; INK 0;") got the
           cheese."''"   ";w$;" won
that one."
 545 IF mn1=0 OR mn2=0 THEN  PAU
SE 200: CLS : FOR f=20 TO -20 ST
EP -2: BEEP .02,f: BEEP .02,f+3:
 NEXT f: GO TO 600
 550 PAUSE 200: GO TO 700
 600 REM broke
 605 PRINT AT 10,8;"GAME OVER"''
"Player 1 has ";mn1;" points"''"
Player 2 has ";mn2;" points"
 630 PRINT AT 17,0;"Press a key
for another game."
 635 PAUSE 0
 640 GO TO 6
 700 REM bet
 702 PAPER 7: CLS : PRINT AT 5,8
; INK 4;"ab";AT 7,8; INK 5;"ab";
AT 9,8; INK 6;"ab": INK 0: PRINT
 AT 5,10;"....1";AT 7,10;"....2"
;AT 9,10;"....3"
 715 PRINT AT 14,3;"Player 1 has
 ";mn1;" points.";AT 16,3;"Playe
r 2 has ";mn2;" points."
 720 INPUT "Player 1 Enter mouse
 No.";m1
 722 GO SUB 800
 725 IF m1<1 OR m1>3 THEN  BEEP
1,0: GO TO 720
 740 INPUT "Player 2 Enter mouse
 No.";m2
 742 GO SUB 800
 745 IF m2<1 OR m2>3 OR m2=m1 TH
EN  BEEP 1,0: GO TO 740
 750 INPUT "Player 1 Enter stake
 ";st1
 752 GO SUB 800
 755 IF st1>mn1 OR st1<0 OR st1<
>INT (st1) THEN  BEEP 1,0: GO TO
 750
 760 INPUT "Player 2 Enter stake
 ";st2
 762 GO SUB 800
 765 IF st2>mn2 OR st2<0 OR st2<
>INT (st2) THEN  BEEP 1,0: GO TO
 760
 770 LET mn1=mn1-st1: LET mn2=mn
2-st2: PRINT AT 14,16;mn1;" poin
ts  ";AT 16,16;mn2;" points  "
 775 GO SUB 800
 780 PAUSE 100
 790 GO TO 102
 800 BEEP .02,20
 805 RETURN
 900 LET x=INT (2+16*RND): LET y
=INT (8+16*RND)
 905 IF ATTR (x,y)<>0 OR ATTR (x
+1,y)<>0 OR ATTR (x,y+2)<>0 OR A
TTR (x+1,y+2)<>0 OR ATTR (x,y+1)
<>0 OR ATTR (x+1,y+1)<>0 THEN  G
O TO 900
 910 BEEP .01,0: BEEP .01,4: BEE
P .01,6: BEEP .01,12
 915 RETURN
 920 LET x=INT (2+16*RND): LET y
=INT (8+19*RND)
 925 IF ATTR (x,y)<>0 OR ATTR (x
+1,y)<>0 OR ATTR (x+2,y)<>0 OR A
TTR (x,y+1)<>0 OR ATTR (x,y+2)<>
0 THEN  GO TO 920
 930 BEEP .01,0: BEEP .01,4: BEE
P .01,6: BEEP .01,12
 935 RETURN
1000 REM move sideways
1005 LET n=RND
1010 IF n>.5 THEN  LET s=1: GO T
O 1020
1015 LET s=-1
1020 IF ATTR (x(i)+s,y(i))=0 AND
 ATTR (x(i)+s,y(i)+1)=0 THEN  LE
T x(i)=x(i)+s: PRINT AT x(i)-s,y
(i); BRIGHT 0; INK 0;"  ";AT x(i
),y(i); INK i+3; BRIGHT 1;"ab":
IF RND>.5 THEN  GO TO 1020
1030 IF ATTR (x(i),y(i)+2)<>0 AN
D (ATTR (x(i)-1,y(i))<>0 OR ATTR
 (x(i)-2,y(i))<>0 OR ATTR (x(i)-
2,y(i)+1)<>0 OR ATTR (x(i)-1,y(i
)+1)<>0) AND (ATTR (x(i)+1,y(i))
<>0 OR ATTR (x(i)+1,y(i)+1)<>0)
THEN  GO TO 1050
1040 RETURN
1050 REM reverse
1052 IF ATTR (x(i),y(i)-i)=0 THE
N  LET y(i)=y(i)-1: PRINT  INK i
+3; BRIGHT 1;AT x(i),y(i);c$;AT
x(i),y(i);b$;AT x(i),y(i)+1; BRI
GHT 0; INK 0;"  ";AT x(i),y(i);
INK i+3; BRIGHT 1;a$: IF RND>.1
THEN  GO TO 1050
1060 RETURN
8500 CLS
8505 PRINT AT 0,10;"INSTRUCTIONS
"''"       A GAME FOR 2 PLAYERS"''
"The three mice who live in the
 wall cavity have a race for the
 cheese.  Being blind, they must
 rely on their sense of smell
 (which isn't too good either!)
 to locate it."
8510 PRINT '"Pick which mouse yo
u think will win, and how much y
ou're        prepaired to bet on
 it (whole   numbers only). The
game ends if a player runs out o
f points."
8514 PRINT '"You win 2 times you
e stake       (plus the stake) if
 you pick thewinner."
8515 PRINT '"Press a key to cont
inue"
8520 PAUSE 0
8525 RETURN
9000 FOR i=1 TO 21
9010 FOR n=0 TO 7
9020 READ a
9030 POKE USR CHR$ (i+143)+n,a
9040 NEXT n
9050 NEXT i
9060 RETURN
9070 DATA 32,71,143,159,127,15,2
4,12
9080 DATA 0,140,204,232,252,255,
16,24
9090 DATA 2,4,8,9,15,0,1,0
9100 DATA 0,120,252,254,255,255,
129,193
9110 DATA 0,192,192,128,192,240,
0,128
9120 DATA 1,1,3,3,3,7,0,30
9130 DATA 254,253,253,253,253,25
3,253,225
9140 DATA 62,126,254,125,120,119
,119,119
9150 DATA 255,0,255,255,0,255,25
5,255
9160 DATA 222,62,126,126,126,126
,124,120
9170 DATA 1,3,2,2,2,2,3,1
9180 DATA 60,66,255,129,255,66,6
0,36
9190 DATA 255,255,66,66,66,66,12
9,129
9200 DATA 0,0,7,15,31,63,127,255
9210 DATA 0,0,255,254,254,250,24
2,226
9220 DATA 66,66,66,64,64,64,64,6
4
9230 DATA 0,0,255,255,255,255,25
5,255
9240 DATA 255,255,129,129,129,12
9,255,255
9250 DATA 1,3,127,100,68,4,4,36
9260 DATA 116,136,16,46,39,39,36
,32
9270 DATA 254,254,124,124,124,12
4,56,0
```



LEAGUE

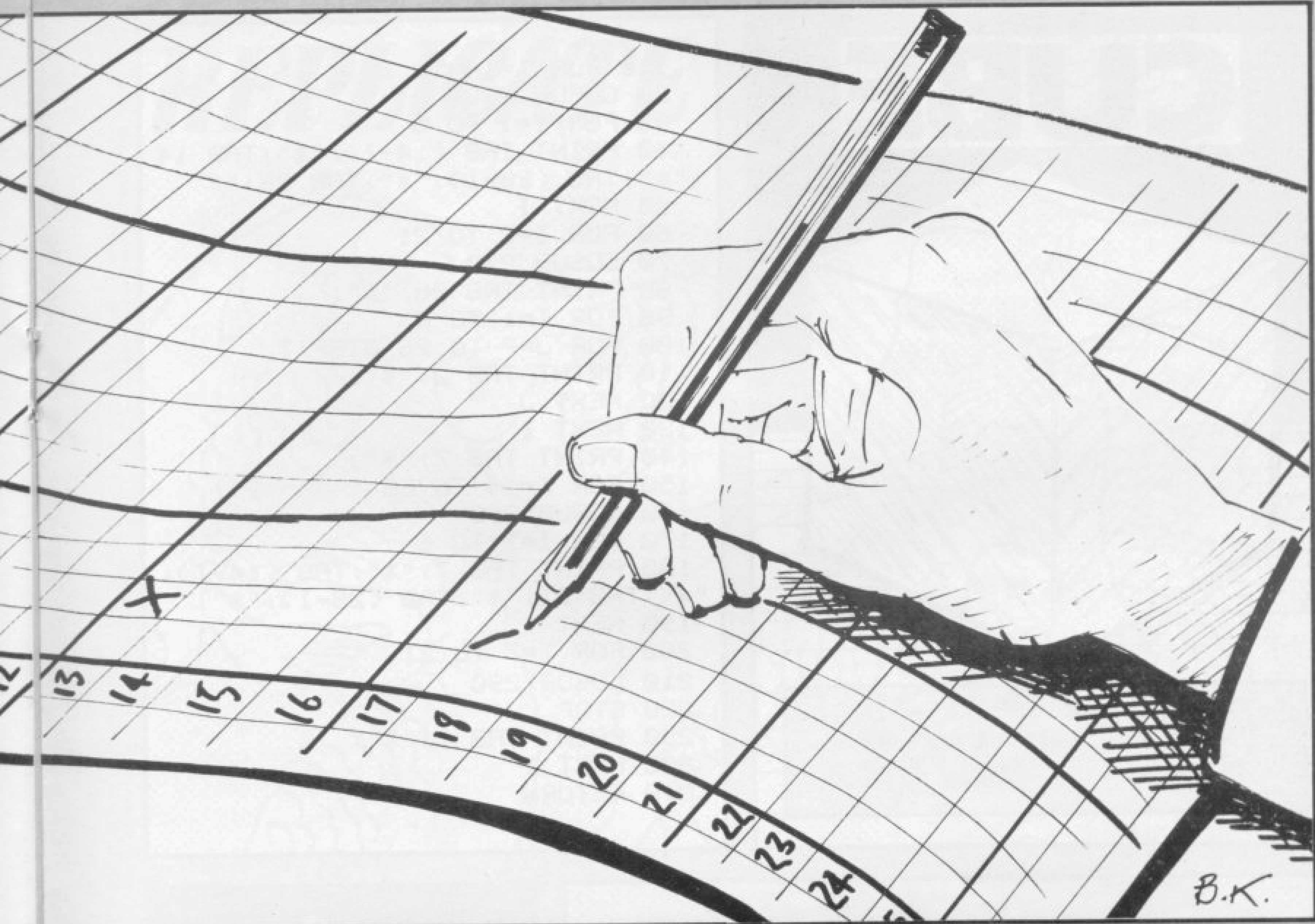


LEAGUE was written by B M Haddow of Alwa, Clackmannanshire for the 16K ZX-81. Enter the **League** scores each week and the positions are computed. It is menu-driven and on loading a list of options is shown. You can enter results, sort the teams, see the positions, save the program or enter a new set of teams.

If you are dealing with the Canon League, change the "2" in line 3260 to "3". If you break out of the program accidentally "goto 10" will return you to the menu.

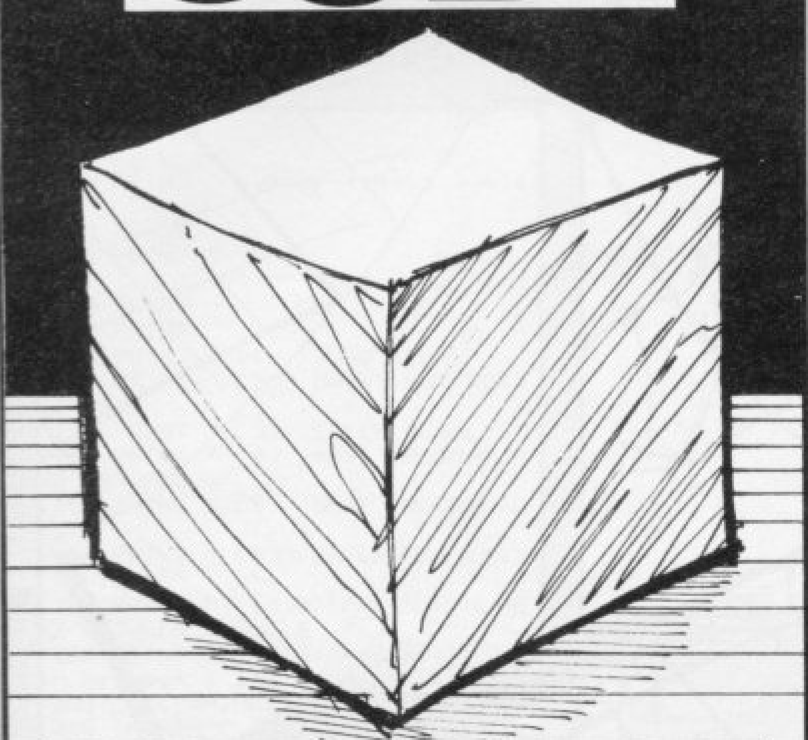
```
  50 CLS
  70 PRINT "(13*isp league 13*is
p)"
  75 PRINT
  80 PRINT "                  menu
     "
  90 PRINT
 100 PRINT
 110 PRINT " (1)  SORT TEAMS"
 120 PRINT " (2)  PRINT OUT POSI
TIONS"
 130 PRINT " (3)  ENTER RESULTS"
 140 PRINT " (4)  SAVE PROGRAM A
ND VARIABLES"
 150 PRINT " (5)  SAVE PROGRAM O
NLY"
 160 PRINT " (6)  ENTER NEW LIST
 OF TEAMS"
 190 PRINT AT 15,0;"PRESS A NUMB
ER BETWEEN 1 AND 6  "
 200 PRINT AT 15,0;"Press a numb
er between 1 and 6  "
 205 LET A$=INKEY$
 210 IF A$="" THEN GOTO 190
 220 IF CODE A$>34 OR CODE A$<29
 THEN GOTO 190
 230 LET A=CODE A$-28
 240 GOTO 1000*A
1030 CLS
1040 PRINT "(13*isp league 13*is
p)"
1050 FAST
1060 FOR I=1 TO DIV
1070 FOR J=1 TO D(I)/2
1075 LET SW=0
1080 FOR K=1 TO D(I)-1 STEP 2
1085 LET A=1
1090 GOSUB 1500
1095 IF A=0 THEN GOTO 1130
1100 LET A$=T$(I,K)
1110 LET T$(I,K)=T$(I,K+1)
1120 LET T$(I,K+1)=A$
1125 LET SW=SW+1
1130 NEXT K
1140 FOR K=2 TO D(I)-2 STEP 2
1145 LET A=1
1150 GOSUB 1500
1155 IF A=0 THEN GOTO 1190
1160 LET A$=T$(I,K)
1170 LET T$(I,K)=T$(I,K+1)
1180 LET T$(I,K+1)=A$
1185 LET SW=SW+1
1190 NEXT K
1195 IF SW=0 THEN GOTO 1210
1200 NEXT J
1210 NEXT I
1220 SLOW
1230 PRINT AT 11,3;"sorting comp
lete"
1240 PAUSE 250
1250 GOTO 10
1500 IF CODE T$(I,K,19)>CODE T$(
I,K+1,19) OR (CODE T$(I,K,19)=CO
DE T$(I,K+1,19) AND CODE T$(I,K,
17)-CODE T$(I,K,18)>CODE T$(I,K+
1,17)-CODE T$(I,K+1,18)) OR (COD
E T$(I,K,19)=CODE T$(I,K+1,19) A
ND CODE T$(I,K,17)-CODE T$(I,K,1
8)=CODE T$(I,K+1,17)-CODE T$(I,K
+1,18) AND CODE T$(I,K,17)>=CODE
 T$(I,K+1,17)) THEN LET A=0
1510 RETURN
2030 CLS
2040 PRINT "(13*isp league 13*is
p)"
2050 PRINT AT 11,0;"WHICH DIVISI
ON?"
2055 INPUT A
2060 IF A>DIV OR A<1 THEN GOTO 2
055
2070 PRINT AT 11,0;"
     "
2075 LET I=0
2080 IF D(A)>19 THEN LET I=D(A)-
19
2090 PRINT "TO CONTINUE THE PRIN
TOUT PRESS   N/L AND TO ""COPY""
PRESS ""Z"""
2095 PRINT
2097 PRINT
2100 PRINT "PRESS NEWLINE TO CON
TINUE"
2110 INPUT A$
2120 CLS
2130 PRINT "(13*isp league 13*is
p)"
2140 PRINT AT 1,0;"TEAM          P
  W  D  L  F  A  P "
2145 PRINT
2150 FOR J=1 TO D(A)-1
2160 LET B$=T$(A,J)
2170 PRINT B$(1 TO 12);TAB 12;CO
DE B$(13);TAB 15;CODE B$(14);TAB
 18;CODE B$(15);TAB 21;CODE B$(1
6);TAB 24;CODE B$(17);TAB 27;COD
E B$(18);TAB 30;CODE B$(19)
2210 NEXT J
2220 INPUT A$
2225 IF A$="Z" THEN COPY
2230 IF I=0 THEN GOTO 10
2240 FOR J=2 TO 21
2250 PRINT "
     "
2260 NEXT J
2270 FOR J=20 TO D(A)
2280 LET B$=T$(A,J)
2290 PRINT B$(1 TO 12);TAB 12;CO
DE B$(13);TAB 15;CODE B$(14);TAB
 18;CODE B$(15);TAB 21;CODE B$(1
6);TAB 24;CODE B$(17);TAB 27;COD
E B$(18);TAB 30;CODE B$(19)
2330 NEXT J
2340 INPUT A$

2345 IF A$="Z" THEN COPY
2350 GOTO 10
3030 CLS
3040 PRINT "(13*isp league 13*is
p)"
3050 PRINT
3060 PRINT "ENTRY OF RESULTS"
3070 PRINT "----------------"
3080 PRINT
3090 PRINT "EACH TEAM IN TURN WI
LL BE       DISPLAYED AND YOU SH
OULD TYPE    THE RESULT IN AS FOL
LOWS :-"
3110 PRINT "FIRST,TWO DIGITS FOR
 THE GOALS    THAT TEAM SCORED"
3120 PRINT "THEN,TWO DIGITS FOR
THE GOALS AGAINST THAT TEAM"
3130 PRINT "E.G.  A TEAM THAT HA
D WON 3-0   WOULD BE ENTERED AS
""0300"""
3140 PRINT "IF A TEAM DID NOT PL
AY THEN      PRESS NEWLINE"
3150 PRINT AT 21,0;"PRESS NEWLIN
E TO CONTINUE"
3160 INPUT A$
3170 CLS
3180 PRINT "(13*isp league 13*is
p)"
3190 PRINT AT 5,0;"division    te
am"
3200 FOR I=1 TO DIV
```




```
3210 FOR J=1 TO D(I)
3220 PRINT AT 5,8;I;AT 5,15;J;"
";AT 6,7;T$(I,J,1 TO 12)
3230 INPUT A$
3233 IF A$="" THEN GOTO 3400
3235 IF LEN A$<>4 THEN GOTO 3230
3240 LET T$(I,J,17)=CHR$ (CODE T
$(I,J,17)+VAL (A$(1 TO 2)))
3250 LET T$(I,J,18)=CHR$ (CODE T
$(I,J,18)+VAL (A$(3 TO 4)))
3253 LET AA=VAL A$(1 TO 2)
_3254 LET BB=VAL A$(3 TO 4)
3260 LET A=2*(AA>BB)+(AA=BB)
3290 LET T$(I,J,19)=CHR$ (CODE T
$(I,J,19)+A)
3300 LET T$(I,J,16-A)=CHR$ (CODE
 T$(I,J,16-A)+1)
3310 LET T$(I,J,13)=CHR$ (CODE T
$(I,J,13)+1)
3400 NEXT J
3410 NEXT I
3420 GOTO 10
4030 CLS
4040 PRINT "(13*isP league 13*is
P)"
4050 PRINT AT 11,0;"WHEN YOU HAV
E SET UP THE TAPE    RECORDER PRE
SS NEWLINE"
4060 INPUT A$
4070 SAVE "LEAGUe"
4080 GOTO 10
5030 CLS
5040 PRINT "                league
5040~PRINT "(13*isP league 13*is
P)"
5050 CLEAR
5060 PRINT AT 11,0;"WHEN YOU HAV
E SET UP THE TAPE    RECORDER PRE
SS NEWLINE"
5070 INPUT A$
5080 SAVE "LEAGUe"
5090 GOTO 10
5999 STOP
6030 CLS
6040 PRINT "(12*isP league 12*is
P)"
6050 PRINT AT 11,0;"ENTER NUMBER
 OF DIVISIONS"
6060 INPUT DIV
6070 DIM D(DIV)
6080 PRINT AT 11,0;"
                                "
6090 FOR I=1 TO DIV
6100 PRINT AT 11,0;"ENTER NUMBER
 OF TEAMS IN DIV.";I
6110 INPUT D(I)
6120 NEXT I
6130 LET H=0
6140 FOR I=1 TO DIV
6150 IF D(I)>H THEN LET H=D(I)
6160 NEXT I
6170 DIM T$(DIV,H,19)
6180 REM ***ENTER TEAMS***
6185 PRINT AT 11,0;"
                                "
6190 FOR I=1 TO DIV
6200 FOR J=1 TO D(I)
6220 PRINT AT 11,0;"division ";I
;"  team no×";J;" "
6230 INPUT A$
6240 IF LEN A$>12 THEN GOTO 6230
6250 LET T$(I,J)=A$
6260 NEXT J
6270 NEXT I
6280 PRINT AT 11,0;"
                                "
  90 PRINT AT 11,0;"HAS THE SEAS
ON STARTED ?(Y/N)"
6300 INPUT A$
6310 IF A$="N" THEN GOTO 10
6320 IF A$<>"Y" THEN GOTO 6290
6325 PRINT AT 11,0;"
                                "
6330 FOR I=1 TO DIV
6340 FOR J=1 TO D(I)
6350 PRINT AT 11,7;T$(I,J,1 TO 1
2)
6360 PRINT AT 12,0;"ENTER GAMES
PLAYED "
6370 INPUT A
6380 LET T$(I,J,13)=CHR$ A
6390 PRINT AT 12,12;"WON        "
6400 INPUT A
6410 LET T$(I,J,14)=CHR$ A
6420 PRINT AT 12,12;"DRAWN"
6430 INPUT A
6440 LET T$(I,J,15)=CHR$ A
6450 PRINT AT 12,12;"LOST       "
6460 INPUT A
6470 LET T$(I,J,16)=CHR$ A
6480 PRINT AT 12,6;"GOALS FOR   "
6490 INPUT A
6500 LET T$(I,J,17)=CHR$ A
6510 PRINT AT 12,12;"AGAINST"
6520 INPUT A
6530 LET T$(I,J,18)=CHR$ A
6540 PRINT AT 12,6;"POINTS SCORE
D    "
6550 INPUT A
6560 LET T$(I,J,19)=CHR$ A
6570 NEXT J
6580 NEXT I
6590 GOTO 10
```

CUBE



Draw a large cube with your 1K ZX-81 using this program written by P Cohn of Noranda, Australia.

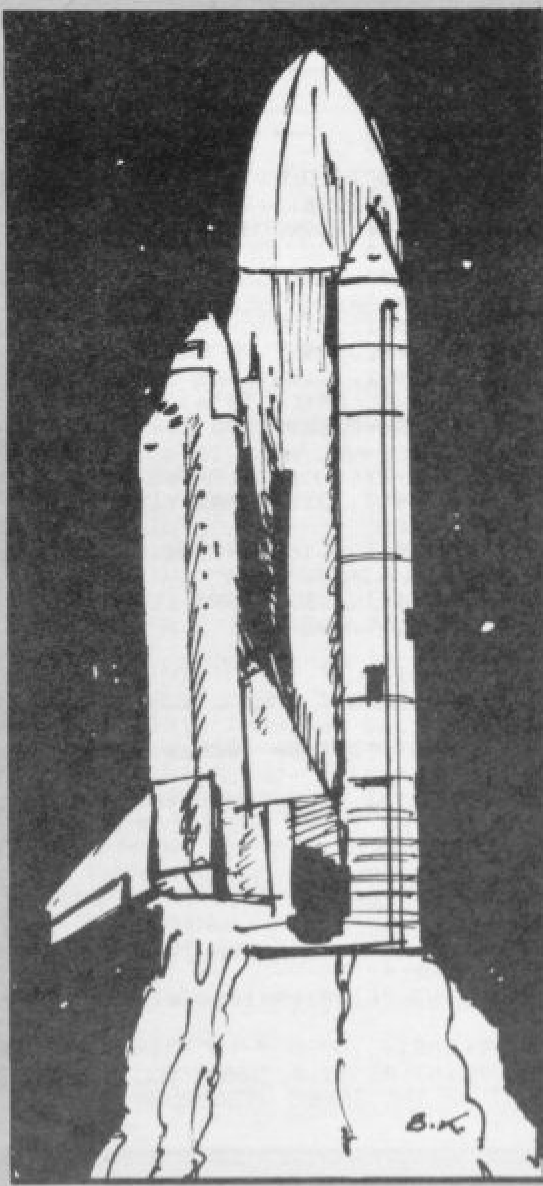
```
 10 FOR I=14 TO 28
 20 GOSUB 290
 30 FOR I=1 TO 6
 40 PRINT TAB (14-I);"*";TAB 14
;"*";TAB (28-I);"*";TAB 28;"*"
 50 NEXT I
 60 FOR I=7 TO 21
 70 GOSUB 290
 80 PRINT TAB 28;"*";
 90 FOR I=1 TO 6
100 FOR J=7 TO 28 STEP 7
110 PRINT TAB J;"*";
120 NEXT J
130 NEXT I
140 PRINT TAB 7;"*";
150 FOR I=14 TO 28
160 GOSUB 290
170 FOR I=1 TO 6
180 PRINT TAB 7;"*";TAB (14-I);
"*";TAB 21;"*";TAB (28-I);"*";
190 NEXT I
200 FOR I=7 TO 21
210 GOSUB 290
220 STOP
290 PRINT TAB I;"*";
300 NEXT I
310 RETURN
```

RUNWAY

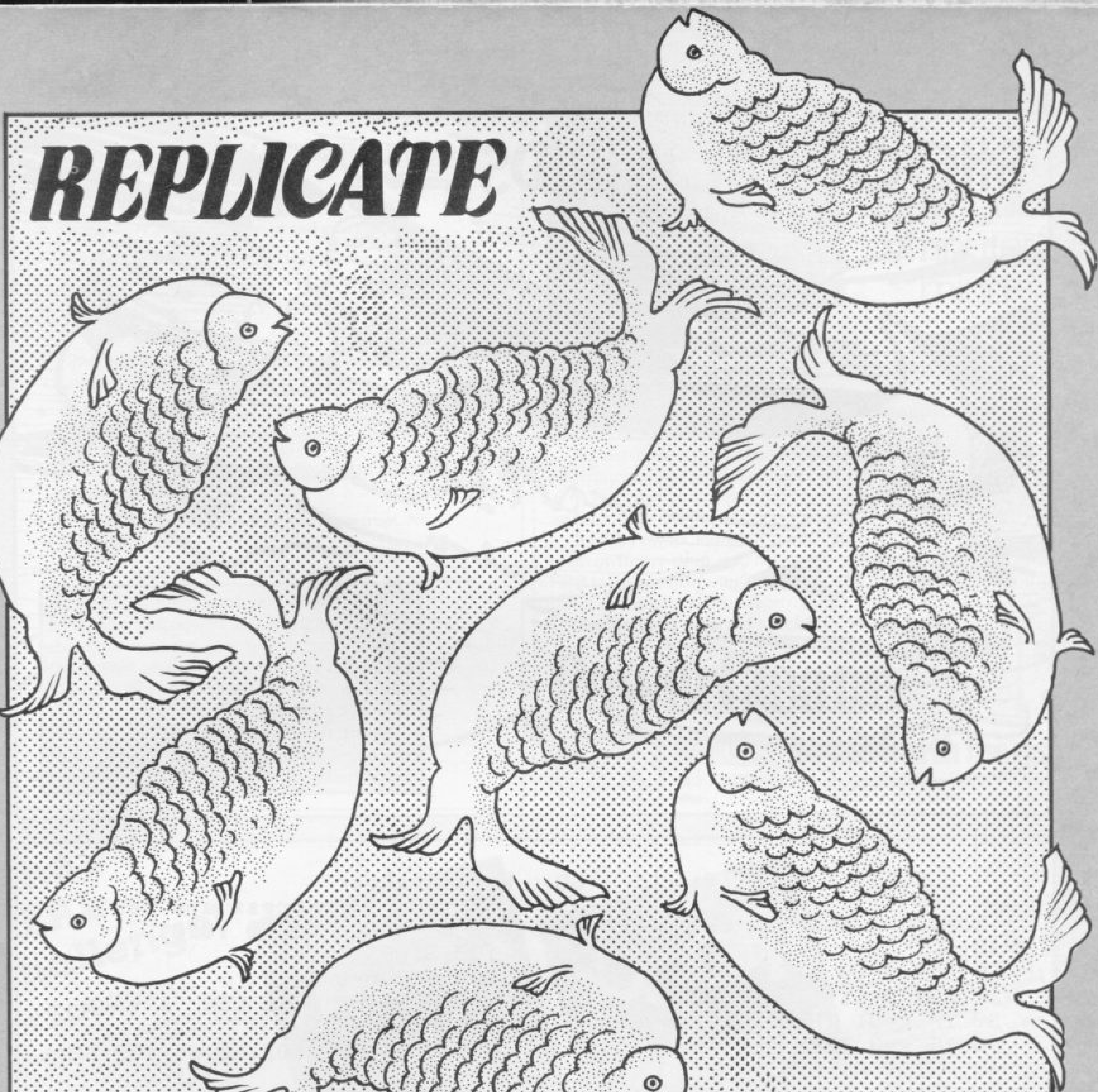
When this program is RUN the runway will appear as a speck on the horizon, and your distance from it (range), height and bearing will be given. Before you overshoot the runway use cursor keys 5 to 8 to bring your bearing and your height to 0.

Written by Simon Hesmondalgh of Milnthorpe, Cumbria for the 1K ZX81.

```
  5 PRINT "WHAT LEVEL? 1-HARD 7
-EASY"
  6 INPUT R
  7 IF R<1 OR R>7 THEN GOTO 5
  8 CLS
 10 LET A=VAL "30"
 12 LET F=INT (RND*5)
 20 LET B=VAL "30"
 25 LET C=R+13
 27 LET E=VAL "10"
 30 PLOT A,C
 40 PLOT B,C
 50 LET A=A-1
 55 LET C=C-1
 60 LET B=B+1
120 IF INKEY$="5" THEN LET F=F-
1
130 IF INKEY$="6" THEN LET E=E-
1
140 IF INKEY$="7" THEN LET E=E+
1
150 IF INKEY$="8" THEN LET F=F+
1
160 PRINT AT 0,0;"RANGE=";C;"HE
IGHT=";E;"BEARING=";F;"      "
170 IF E=0 AND C=0 THEN STOP
180 IF C=0 AND E=0 AND F=0 THEN
PRINT "GOOD LANDING"
185 IF C<0 THEN STOP
190 GOTO 30
```



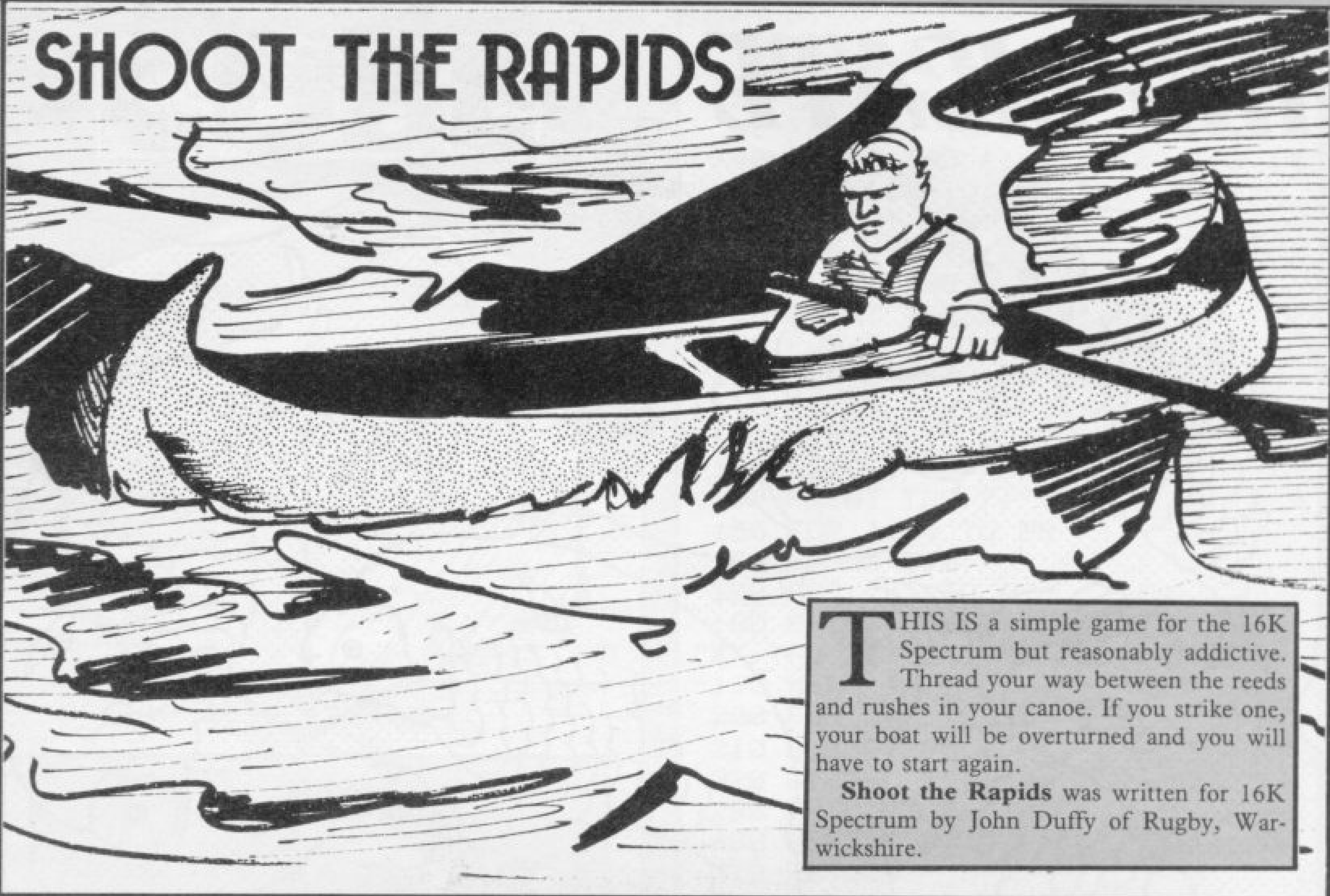
REPLICATE



REPLICATE was written by Russel Shaw, aged 14, of Hemel Hempstead, Herts. Using the cursor keys you avoid the robot "X" to throw him off the trail and leave red herrings behind you. If he hits your trail he will be destroyed but he can form a replica which you must avoid. **Replicate** is for the 16K ZX-81.

```
   2 POKE 16418,0
   3 FOR A=0 TO 23
   4 PRINT AT A,0;"(32*ISP)"
   5 NEXT A
   6 LET B=CODE ":"
   7 LET C=CODE ";"
   8 LET D=(RND*CODE "(9s")+CODE
 "(95)"
   9 LET E=(RND*CODE "9s")+CODE
"(95)"
  10 PRINT AT B,C;"(INVO)";AT D,
E;"(INVX)";AT B,C;"(INV,)"
  11 LET B=B+(INKEY$="6")-(INKEY
$="7")
  12 LET C=C+(INKEY$="8")-(INKEY
$="5")
  13 PRINT AT B,C;
  14 IF PEEK (PEEK 16398+256*PEE
K 16399)=CODE "(9e)" THEN GOTO C
ODE ","
  15 PRINT AT D,E;"(9e)"
  16 LET D=D+(RND*CODE "97")-1.5
  17 LET E=E+(RND*CODE "97")-1.5
  18 IF B=0 THEN LET B=22
  19 IF B=23 THEN LET B=1
  20 IF C=0 THEN LET C=30
  21 IF C=31 THEN LET C=1
  22 IF RND>.9 THEN GOTO CODE "(
9a)"
  23 PRINT AT D,E;
  24 IF PEEK (PEEK 16398+256*PEE
K 16399)=CODE "(INV,)" THEN GOTO
 CODE "2"
  25 GOTO CODE "(9s)"
  26 FOR Z=0 TO 21
  27 PRINT AT Z,0;" you are kill
ed dou hit a mine "
  28 NEXT Z
  29 GOTO CODE "(92)"
  30 FOR G=1 TO 50
  31 PRINT AT D,E;"(9t)";AT D,E;
"(9w)"
  32 NEXT G
  34 FOR H=0 TO 21
  35 PRINT AT H,0;"congratulaton
s   congratulatons "
  36 NEXT H
  37 FOR I=1 TO 75
  38 NEXT I
  39 FOR J=0 TO 21
  40 PRINT AT J,0;"the robots de
ad  the robots dead"
  41 NEXT J
  42 GOTO 2
```

SHOOT THE RAPIDS



THIS IS a simple game for the 16K Spectrum but reasonably addictive. Thread your way between the reeds and rushes in your canoe. If you strike one, your boat will be overturned and you will have to start again.

Shoot the Rapids was written for 16K Spectrum by John Duffy of Rugby, Warwickshire.

```
   1 BORDER 6: PAPER 6: CLS : GO
 SUB 200
   5 POKE 23609,30: CLS : LET hs
=-10
  10 LET x=10
  20 FOR n=-11 TO 10000
  30 IF x=31 THEN  LET x=30
  35 IF x=0 THEN  LET x=1
  40 PRINT AT 6,x;"s"
  50 PRINT  INK 2;AT 18,INT (RND
*32);"***"
  70 IF INKEY$="5" THEN  LET x=x
-1
  80 IF INKEY$="8" THEN  LET x=x
+1
  90 POKE 23692,255: PRINT AT 21
,31;"  "
 100 IF SCREEN$ (6,x)="*" THEN
GO TO 1000
 110 NEXT n
 120 CLS
 130 PRINT AT 5,5; INK 3;"Well d
one!You have scored  ";AT 8,10;
INK 3;"10000"
 140 PRINT ''" You have come to
the end of thegame.Change line 2
0 to make it  longer"
 160  PRINT  INK 2;''" Change th
e number of""*"" in line50 to ma
ke it harder"
 170 PRINT ''"Press any key": PA
USE 0: CLS : GO TO 1010
 180 STOP
 200 FOR n=0 TO 7
 210 READ d: POKE USR "s"+n,d
 220 NEXT n
 230 DATA 102,102,60,66,153,66,6
0,24
 240 PRINT "  Avoid the obstacle
s by moving left and right using
 ""5"" and ""8""": PRINT ''"Any
key to start": PAUSE 0: RETURN
1000 BEEP .5,-30: CLS : PRINT  I
NK 1;AT 2,5;"You hit an obstacle
"
1010 PRINT  INK 2;AT 5,5;"You sc
ored ";n-1;" Points"
1020 IF n>hs THEN  LET hs=n-1: G
O TO 1060
1030 PRINT AT 8,5;"Highest score
 so far  ";AT 10,5;"is ";hs;",by
";a$
1040 GO TO 1070
1060 INPUT "Enter your name",a$:
 GO TO 1030
1070 PRINT  INK 3;AT 15,5;"Anoth
er go? (any key)": PAUSE 0
1080 CLS : GO TO 10
```


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JUMBLY 48K Spectrum (joystick compatiable)

Programs lighten the load of a Methodist minister

The Rev John Wall uses his Spectrum to plan services and visits in his parish. Flo Barker reports

IN THE BEGINNING, there was the word. . . then there was The Plan. . . and now there is the ZX-81. The problem of The Plan, a time-table of preachers in the churches in an area is a real headache for Methodist ministers.

Hours of head-scratching are spent and reams of paper used matching preachers and churches but now the problem has been cracked thanks to the Rev John Wall and his ZX-81.

Wall used to spend a morning with another minister determining which preachers would take the Sunday services in the following three months in the 16 churches in his area. Each lay preacher, who perhaps had other commitments on particular days, or transport problems, had to be allocated suitable times and churches. Congregations would want a variety of preachers visiting their churches, rather than the same faces recurring.

Wall, who is in the Newcastle-upon-Tyne (West) circuit, saw a perfect opportunity to put his ZX-81 to work. "I thought it was an ideal problem for the computer to accept the maximum amount of offers from local preachers and to make sure every church has a preacher every Sunday," says Wall, who bought his ZX-81 a little more than a year ago.

"The Plan is very complicated. In my area, seven out of 10 services are taken by local lay preachers rather than ministers. Those preachers lay down conditions on when they are free to preach and in what areas."

Months of hard work later, he produced a program which prevents him interrupting his busy schedule to devote hours to the plan of services. "You enter the preachers' requirements; then, each quarter, you enter the churches and the dates," he says.

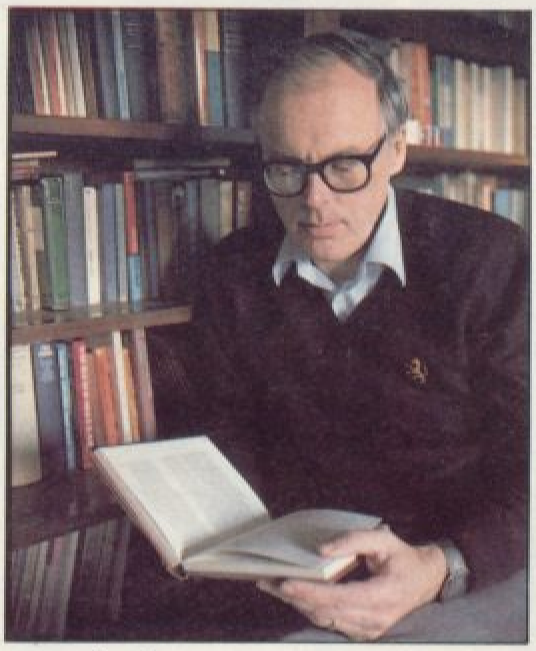
"The computer searches two of the factors in a random way — picks out a random Sunday and a random service. Then it searches through the preachers in accordance with how many appointments they offer. It works its way down until the particular slot is filled."

That, says Wall, gives him a morning's work in 15 minutes. If he does not like what the computer provides, he can ask it for another time-table. Now he has adapted the program for his 48K Spectrum which he bought recently.

"The Spectrum will cope with 40 services and 40 local preachers. It uses about 31K of program, which leaves 9K unused," he says.

Wall, aged 51, who has a degree in mathematics and physics from Newcastle University, believes his program could be adapted to save Methodist ministers hours of work.

"There are 500 circuits throughout the country. Some are small but my programs could help with the bigger ones. As the computer would be used only four times a year, ministers could easily borrow one if necessary."



His services program is not the only way Wall uses his computers to lighten the load of looking after nearly 1,000 members of the Methodist church.

"When I moved here from Stockton-on-Tees last year I found I had far more people than I had previously, so I decided to do a program for the ZX-81 to deal with the problem of visiting them systematically.

"I based the program on everyone having one visit a year although some, like the elderly housebound, need more."

It took him a month to make a program which allows him, every Monday morning, to obtain a list of people who should be visited that week.

"I think it would take me nearly half an hour every day to work out whom I should visit. Now it sets my mind at rest, because I know I am visiting systematically as many as I can. If I do not visit someone it tells me again and again until I make the visit."

At the end of a week he tells the computer how many visits he has made and the system works so well that he has even been able to program it to allow him July and August off from routine visiting to catch up on some gardening.

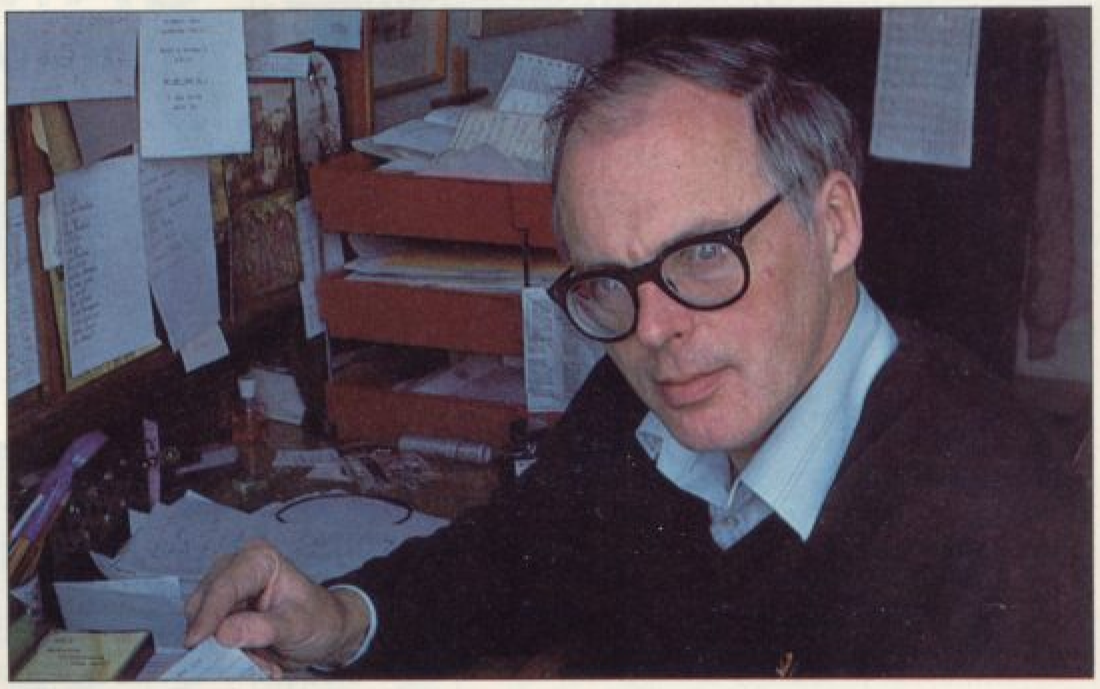
"The data entry was fairly simple and a program such as this could be useful for all kinds of people who make routine visits, such as health visitors," he says. Wall is still working on the program to improve it for the Spectrum but at present he is satisfied the ZX-81 has saved him even more time in his busy programme of duties.

"I am interested in getting as much as I can from the equipment I have," he says.

He is happy with his ZX-81 with its home-made Maplin keyboard, its printer and a 16K RAM pack. He bought the Spectrum for its extra memory and facilities and uses the computer with two tape recorders and a black-and-white portable television. He finds his keyboard invaluable, as it means the RAM pack or printer cannot be knocked by mistake.

"The reliability of saving and loading and its extra memory made me swap to the Spectrum but I am very pleased still with the ZX-81. I do not bother with colour and although I play games occasionally, like The Hobbit, I soon lose interest. I am concerned with data handling for the job."

After graduating from university, Wall spent some years teaching at Richmond and then Darlington before training as a minister. His first appointment was in Suffolk and then he moved to Norwich for six years as a circuit minister. He spent five years at Chesterfield



before moving to Stockton-on-Tees and, finally, to Ponteland, near Newcastle, where he lives with his wife and three children.

Years ago he toyed with the idea of making a valve-operated analogue computer and constructed an amplifier for it. "I never really finished it," he says. Now his study has a neat computer corner beside a wall lined with rows of theological books and pictures of local landscapes.

It was the lure of having tried a friend's computer which made the forward-thinking minister decide to buy a ZX-81. "I did all the programs in the book and learned how it works. I know Basic now but I am not so good on machine code," he explains.

Wall is a family man and his younger son, Simon, shares his interest in computers, although his first love is for graphics. "I suppose one of my original excuses for buying a computer was for my children, to let them grow up computerate as well as numerate and literate," he says.

That belief, combined with his teaching experience, led him to compile a teaching program which he sees as having great potential for Sunday School.

"I took the story of Moses and made a program asking questions which can be answered by referring to the Bible." If a youngster keys-in the correct answer he is awarded points and given an encouraging message. If he needs help, he is told a Bible reference.

That program was a great hit with a group of teenagers Wall took on a weekend trip recently. "It acted as a stimulus. When we played the Moses game the children all thumbed through their Bibles for the answers. Otherwise they might not have done so.

"I think this kind of thing has great possibilities. What is needed in education is for people to think about how you can put things together to make a program which will teach. If I can make a format which would allow people to type-in questions and answers to make their own programs, there are plenty of people in the church with computers who will help."

His schemes have aroused plenty of interest already among his church members, many of whom are intrigued when he tells them his routine visit was master-minded by a computer.

He is planning a meeting for church members to try to develop his ideas and has already been in touch with other Methodist ministers about his Plan of Service program.

"Some ministers from the circuits think it is fine and others think 'blooming machines'. There are always some Luddites in anything."

He is planning to show his assistants how to operate his programs and is hoping for help with one particular project. By using a Campbell system master file on the Spectrum, he is compiling a list of the 400 households in his area.

He has also added useful information such as addresses, telephone numbers, marital status and to what organisations, such as the choir or women's fellowships in the church, they belong.

"I have put on only about 85 households so far and I am hoping for a little help programming in the rest," he says.

Wall is full of ideas for his computers — and not just for church affairs. He spends any free time he can experimenting with his equipment.

> 'I think there are computers all over the country waiting for problems to solve'

As a chess enthusiast, an interest he shares with his elder son Timothy, who was the British under-16 champion two years ago, he sees several ways of using computers in that field. Recently he compiled a program to let the computer act as a clock to monitor the time between moves in a chess game.

"I am also thinking about the possibility of making a program to help run chess tournaments, which needs a particularly logical approach to organise the complicated pairings," he explains.

Another scheme which involves the church is his idea for a computer-run scroll notice-board of church events. He has ear-marked an appropriate position for a screen behind a pane of glass at the church front door.

A word-processor, too, he believes, would have great potential in helping ministers to write their sermons.

"I prefer notes on the back of an envelope but a word processor would be useful if you were typing a sermon and wanted to make alterations."

The idea which has given him the most satisfaction, though, is his Plan of Service program. "Factories and businesses use that kind of program to get the maximum use of a plant. This will make up the Methodist Plan for any part of the country and I do not see why the church should not use it."

Eventually, Wall envisages the whole church using computers which could be linked to provide a nation-wide network.

"I think there are computers all over the country waiting for people to give them problems to solve. That's where the blockage lies — in finding work for them. This country is extremely lucky to be so advanced with the micro-chip."

He believes people must overcome their distrust of the unknown and accept that computers can be put to work to help with many of the tasks of daily life.

"Many people think if they are to be interested in computers they will have to understand how they work and be able to program them, yet there are hundreds of thousands of people who can copy programs and there should be millions who can use them.

"You do not have to be able to understand computers — just to know how to use them."





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Campbell Syste	Programs	secret
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Ding J	Admin	9000
Ewing J R	Chairman	90000
John	Sales	15500

EXAMPLE: ONE RECORD PER PAGE...

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Admin	Zimmerman A.
Chairman	Ewing J.R.
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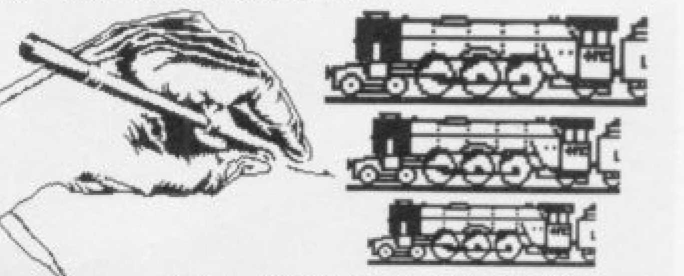
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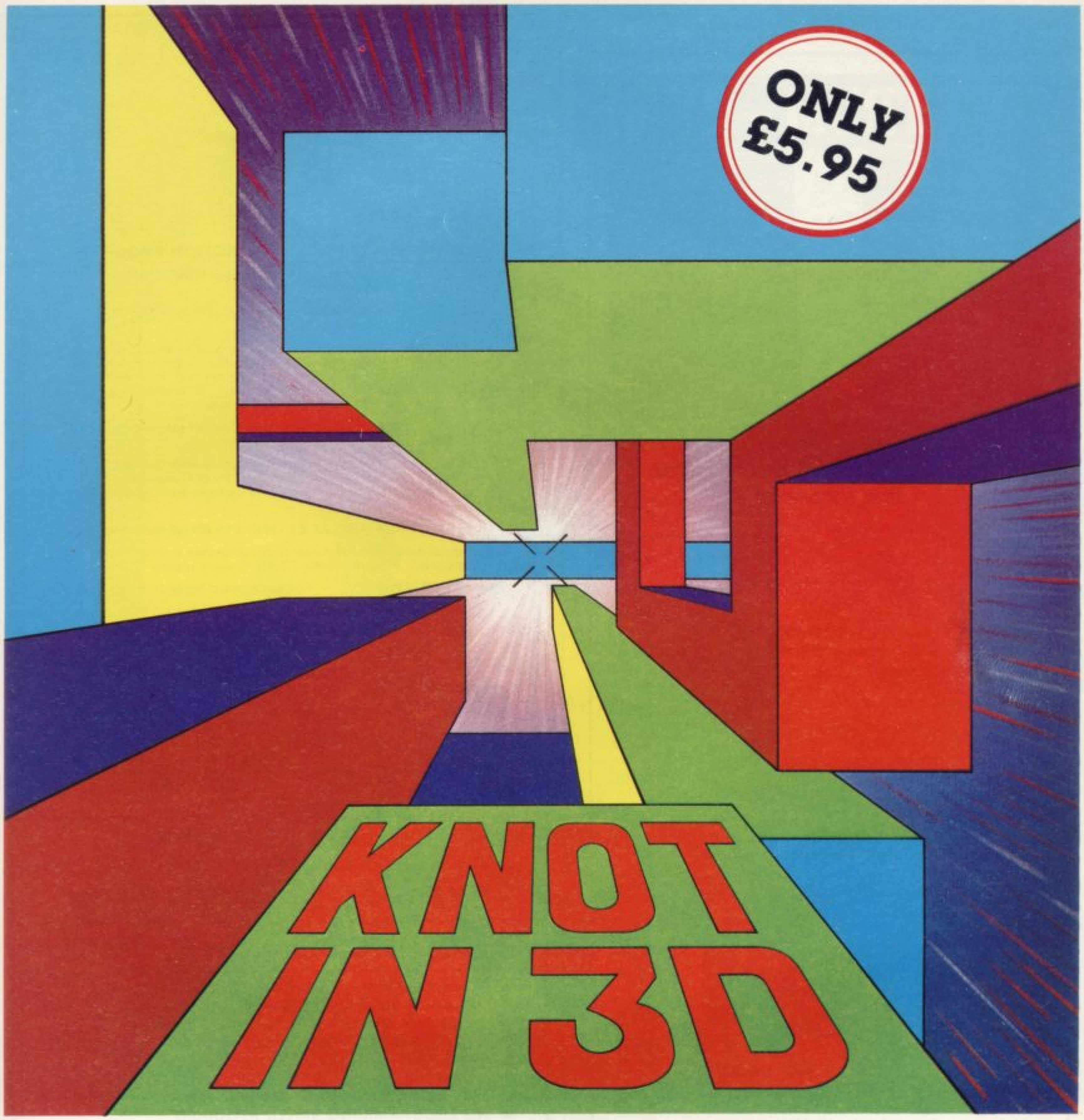
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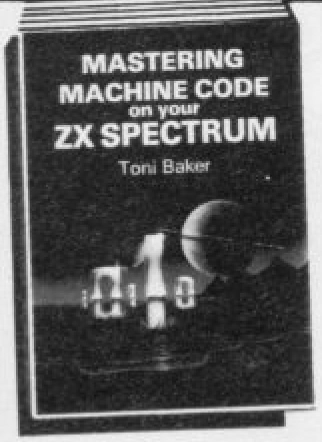
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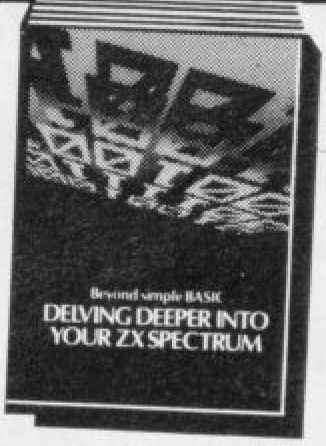
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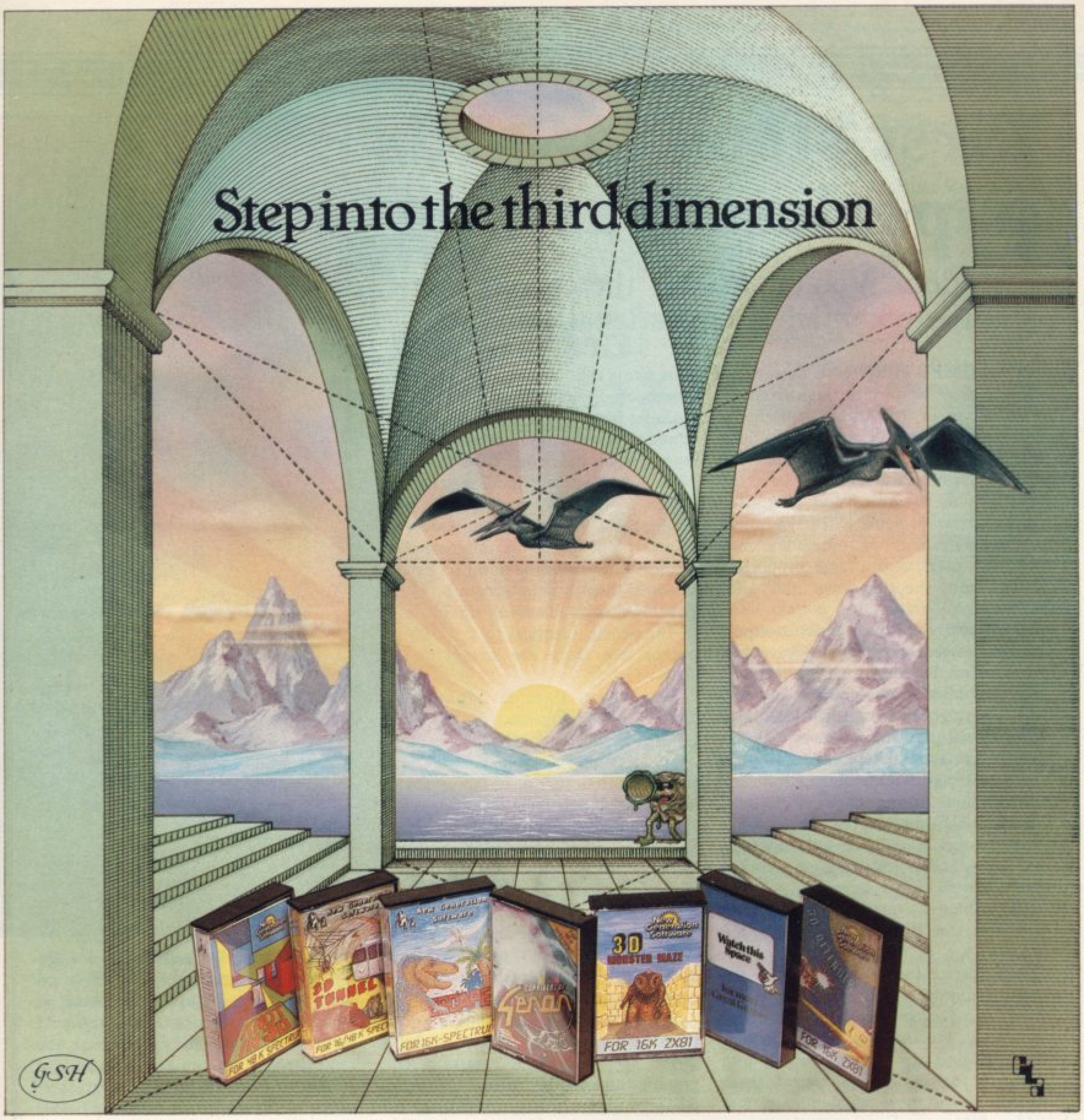


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First steps towards paperless learning

Theodora Wood considers the current state and the potential of educational software

COMPUTERS have now found their way into approximately one in 10 British households. Half a million Spectrums alone have been sold and presumably at least twice as many adults and children have unwrapped their cartons and plugged-in their hardware. Some will have caught the programming bug, others are small business users, and a large proportion have been shooting-down the alien hordes.

Software houses were quick to supply the games market and some have provided educational software but it is only recently that the numbers of educational titles have risen, with the large educational publishing houses realising the potential of the market, complete with glossy packaging and nation-wide distribution. At present Britain lags behind the U.S. market, both in the range and number of educational programs available, and is following roughly the same pattern of development.

The biggest number of programs available, for both the Spectrum and ZX-81, are of the rule-drill variety. They operate in the same way as the most traditional methods of teaching, by showing examples of the subject to be taught and then testing, sometimes by games. They can be divided into those for the younger age group — three to nine — and those which are aimed at older children as learning packages.

For the younger children the lack of reading skill places a greater emphasis on the use of graphics, animation and sound in the programs used to teach basic skills such as letter recognition, counting, simple mathematics. It is important with programs such as those that there should be a substantial element of interaction with the computer — children love pressing buttons. The testing part of the programs provides for that in most cases and duplicates the worksheets and workbooks used in schools throughout the country in electronic form.

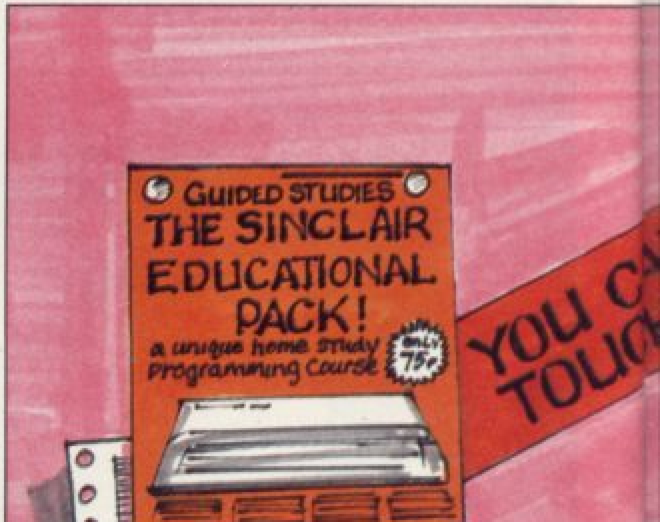
First Numbers — Collins Educational, 16K Spectrum, £5.95 — is a series of five programs on one tape illustrating the concept of the electronic workbook. Instead of the examples remaining inert on the page, they bound round the screen in full colour; hopping frogs, seals bouncing balls on their noses, and elephants moving across the screen, rather too slowly, to the tune Nellie the Elephant, all emphasise the numbers one to 10. A program illustrates how to write the numbers by first drawing them on the screen and then flashing arrows following the direction of the pencil, identical to a workbook, except that there the arrows do not flash.

In contrast, there is **Alphabet** — Widget, 48K Spectrum, £5.95 — a program to teach letter recognition which uses no on-screen movement to illustrate its point. Its use of the Spectrum sound capability is lamentable, as the reward for a correct answer is the same for every letter, and can become extremely tedious even for the youngest child. When attempting to teach letter recognition, which is essentially a sound/shape matching activity, it is important that an adult should be present, as without a voice element the objective cannot be realised.

For the younger child who has little or no reading ability, better capability of the Spectrum in the area of colour, graphics and sound make it a superior machine to the ZX-81. Moving up the age range, a considerable number of programs operate on the electronic workbook level, from junior up to O level and beyond, and they are widely-available either at department stores or by mail order.

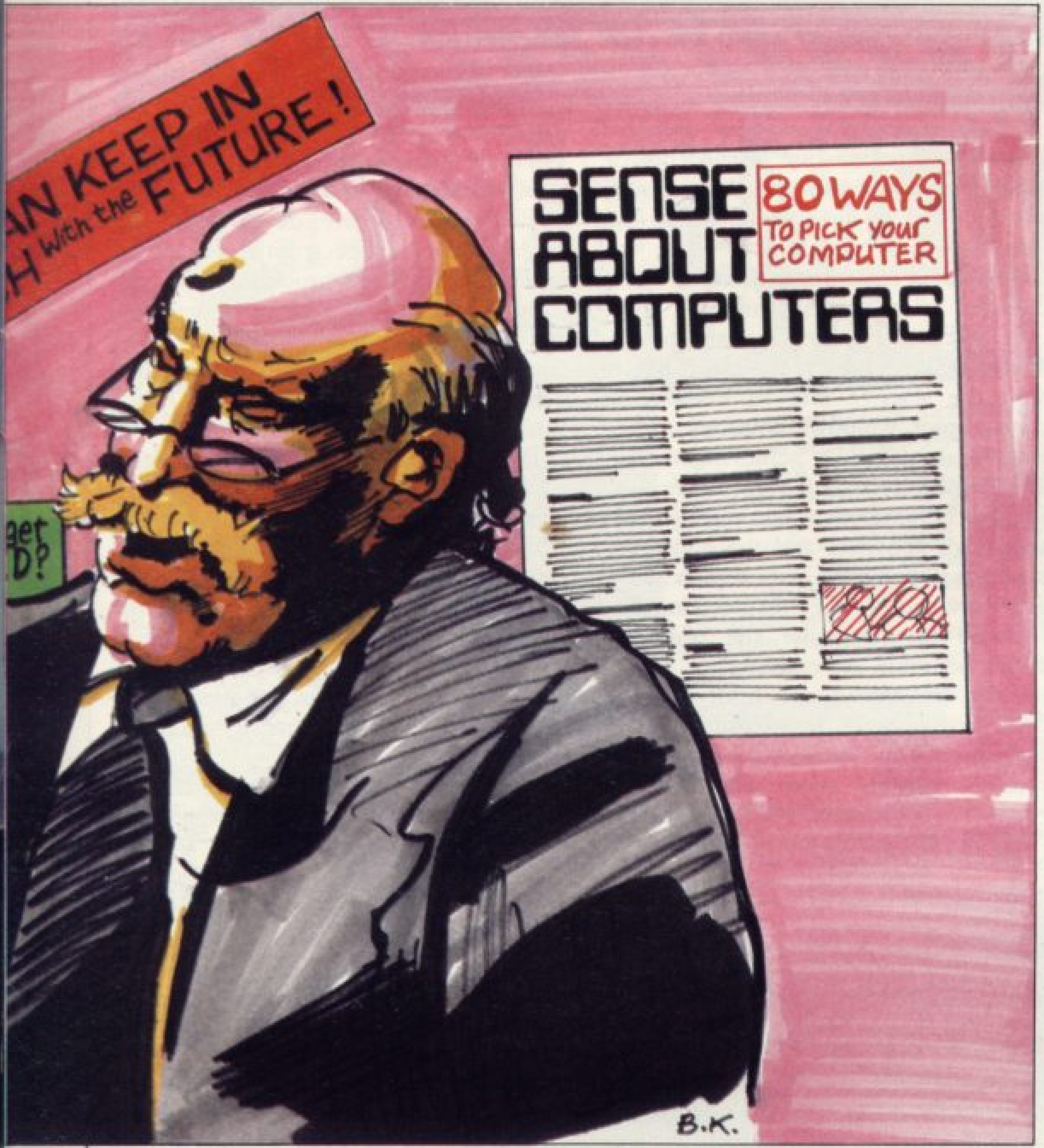
The ZX-81 appears more regularly in those titles, where more on-screen text can be used and flashing graphics are not so important. That kind of program would be a valuable aid to learning for the motivated child and for examination revision. Rose Cassettes and University Software specialise in that kind of programs.

Quiz programs are an extension of the question-and-answer format, such as the ones produced by Psion — 16/48K Spectrum, £6.95 — for geography and history. **Time Traveller** — John Wiley, 48K Spectrum only, £9.95 — extends the scope by using the format of an adventure game, complete with wild animals, soldiers and priests, at the same time testing a child's knowledge of history through having to answer questions on historical fact correctly before passing through the time warps from 2000 BC to the present. This type of quiz would obviously have more attractions than the more straightforward versions, and would be more entertaining for groups.



All the programs mentioned so far are an extension of traditional teaching methods and provide a paperless way of learning subjects as diverse as O level French revision and the history of inventions. For the younger age groups they could be a valuable aid to learning basic skills, if used for short periods, and should be compared to other hardware aids such as **Speak and Spell,** the **Talking Computer** and **Little Professor** to assess their effectiveness.

They also provide an introduction to



the use of the computer and its keyboard. In the short term a child's interest would be retained probably by the novelty value of using a computer but that may later prove ephemeral as electronic workbooks become a more familiar feature at home and at school. Older children could use them in conjunction with their studies to clarify and identify areas on which they need to concentrate.

Simulation programs present a real departure from the electronic workbook and use the ability of the computer to deal with interactive variables to the full. Simulation programs at their best place a child in a real situation, engaging attention in an imaginative way. Again, the superior Spectrum graphics and colour invalidate the use of the ZX-81 and most titles are available for 48K Spectrum only.

Heinemann has produced a package for the eight-to-12 age group, **Ballooning,** which is accompanied by a glossy booklet explaining ballooning, with its history, development and suggestions for further activities. The balloon moves over a simulated landscape at the top of the screen while a child interacting with information on the dials placed below — altitude, temperature, fuel, rate of climb or fall — controls the upward or downward drift of the craft.

The child can stop the action to make a decision more coolly or mark position on a graph relating to altitude and distance, thus simulating a barograph. By practising at the controls of the balloon, a novice balloonist can execute various missions set by the program, some of which are extremely complicated, and in so doing become aware of the interaction between the temperature of the air inside the balloon, its rise and fall and its limitations as a flying machine.

The variety of other activities suggested in the accompanying booklet ensures that the program is open-ended and the concepts introduced in the package explored in different ways. Meanwhile, arguments rage as to who has achieved the most number of safe landings. **Flight Simulation** — 48K Spectrum, Psion, £7.95 — and to a lesser extent **Nightflite** — 16K Spectrum, Hewson — together with a 16K ZX-81 version, are similar programs suitable for nine-year-olds upwards and continue the theme of flying a machine but with greater difficulty level. Real-time means precisely that and there is no stopping the action to assimilate the information on the dials.

Map reading and basic navigational skills are also needed to move the aircraft round the landscape in the case of the 48K version, and the impression of reality is enhanced by being in the cockpit, seeing the landmarks below, and experiencing the tilt of the aeroplane in relation to the horizon, as well as the dizzying effect of rushing towards the ground at an increasingly frightening rate.

Simulation programs prove an imaginative vehicle for the introduction of the terminology used and the concepts involved in a particular activity and accomplish it in a different way from the rule and drill programs; instead of learning by example a child learns by the consequences of actions, albeit within the limitations of a simulated micro-world.

Learning by direct experience is more valuable than learning by rote and one would expect that more programs of this kind would be available in 1984, to introduce chidren to a wide variety of concepts and situations.

There are also programs for both the Spectrum and ZX-81 which operate in specialist areas not covered by the rule-and-drill format. Programs such as **Firework Music** and **Tuner** — 16/48K Spectrum range for 16K ZX-81, Software Cottage, £5 each — introduce children of almost any age to the basics of musical notation, pitch and keyboard use, and are ideal for use where a household has a computer but no musical instruments as, sad to say, only a minority of children retain an interest in playing music beyond a certain age.

Bridge Software produces a program, **Night Sky** — 16K Spectrum, £8.90 — which shows the stars visible at any time of the day or night from the Midlands — 0°, 52°N — on any day of the year. The second program in the pack shows the stars appearing in order of magnitude, with the 20 brightest stars named. Although operating within a specialist field, this type of program is of note as it adds an extra dimension to the star maps in books; moving the time

continued on page 104

continued from page 111

on hour by hour shows the viewer how the stars rise and fall throughout the night and their positions throughout the year.

It also gives city dwellers a chance to look at the stars which are rarely seen through the orange glare of street lights and seen even more rarely at 3 o'clock in the morning.

The state of the art of educational software for the Spectrum and the ZX-81 introduces children to the keyboard of the computer — just watch a three-year-old press ENTER — and the notion of paperless work while reinforcing the learning processes involved in gaining skills which are basic to any educational curriculum. They can also introduce new concepts in an exciting way through the use of simulation techniques. None of them, however, deals with the use of the computer in the programming field.

The Microelectronics Education Programme was designed initially for use in schools and contains some programs which teach skills which are the stepping stones to logic and programming techniques, as well as the more usual rule-and-drill programs. At £24.95 per pack of seven to eight programs, it seems rather expensive for home use but its use in schools is a selling point for distributors such as W H Smith.

Farmer introduces problem-solving and reasoning to the seven-to-11 group, while **Watchperson** does a similar task for the eight-to-11 group and includes route planning. Mazes are a graphic way to introduce logical processes and many of them are available in the games section of the software departments of stores.

To learn programming as a technique, the most innovative and child-centred way is to use Logo, a high-level language developed at Massachusetts Institute of Technology, under the guidance of Seymour Papert. Instead of using the computer to help a child or young adult to learn certain skills, the user programs the computer to execute commands. Logo enables children from about nine upwards to achieve results which would be much more difficult to achieve using the Basic language common to the Spectrum and ZX-81.

By the use of simple commands, a child can instruct a robot/turtle to move round the screen or on the floor, drawing as it proceeds. Imagine telling someone to walk round a square shape; walk 10 steps, then turn right; at that point it would be absolutely essential to know how many degrees to turn through, otherwise the shape would have no chance of being a square. Similarly with Logo and it is in that way that the value of such a program can be seen, as geometric functions are learned not by looking at a text book but by practical use of them in an activity which has been chosen by the child.

Logo does much more than introduce children to geometric function, however, because by choosing a problem, like drawing a house, the child has to split the activity into its component parts — roof, windows, chimneys — and find the best way of achieving the desired result. That type of problem-solving can be applied to any number and variety of activities and the adult version is well-known as critical path analysis, involving the exploration of logistics to determine the order in which activities are executed.

Logo also introduces children to the basic concepts of programming in a simplified form — to loops, nested loops *et al* — and for those who have no immediate knowledge of, or affinity with, those concepts, its simplicity is an easy introduction to them. In future years robots and artificial intelligence will enter many areas of life and a knowledge of the logical way in which a programmable machine works will undoubtedly be a skill which many will need to learn.

Snail Logo — Spectrum 48K, CP Software, £9.95 — is an example of this type of program which can be used either with the Zeaker turtle on the floor or displays, if desired, a snail moving on the screen.

The documentation with the program is excellent, describing the concepts behind it and giving examples of programs to try. They lead the novice from simple routines to more complex ones involving the use of named procedures — subroutines — and variables. Although there are ample facilities to copy the program being worked on, there is no means of saving them, which is very irritating, as obviously children might wish to evolve a program in the space of days or weeks. It would be better also if the snail could be seen on the screen at the same time. No doubt other versions of Logo will be introduced in the coming year.

Looking back on the development of educational software at the start of 1984, the main impression is that the field has scarcely been explored. Two obvious areas where development is necessary for the Spectrum and the ZX-81 is a simple word processor allowing children to type-in a piece of writing and then correct it, and the interactive database program similar to that of the **Tree of Life** which runs on the BBC micro.

Potential exists in the simulation/adventure format and the use of Logo to stimulate children into areas of activity which would be impossible without the use of the computer. While rule-and-drill programs can be a pleasant way of learning basic skills and an introduction to the computer and its keyboard, their over-use could have the opposite effect to that desired by deterring children using computers for life.

So what developments can we expect in the next few years? Interactive video must surely be an area to be explored. Based on a combination of personal computers and video tapes or disc players, interactive video will expand the use of the computer as an educational tool by introducing real speech into the learning process and enabling children to interact with the pictures.

After that, perhaps children will learn to program holograms to dance round the room or a myriad of small independent robots will be whizzing round when fed their programs. Educational software? We have only just begun.

'While rule-and-drill programs can be a pleasant way of learning basic skills and an introduction to the computer and its keyboard, their over-use could have the opposite effect to that desired'

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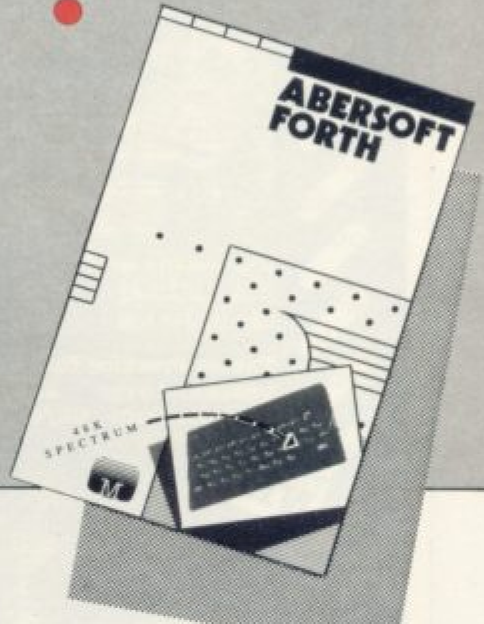
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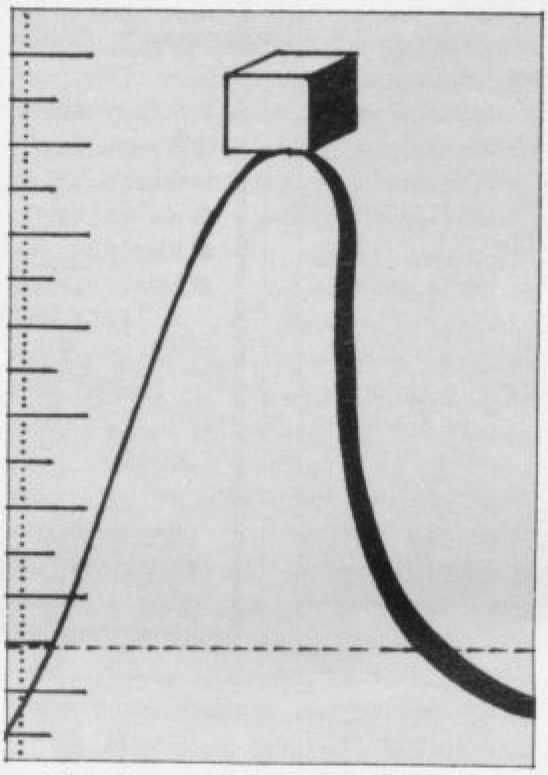
Robert Shipley explains how to generate sound effects on the Spectrum using six simple routines

FOR SOUND generation using Spectrum machine code, the first thing you must learn is how to assign values to variables. In machine code there are only eight main variables. They are not called variables but registers. They are A, B, C, D, E, F, H and L and they can have a value between 0 and 255. If you pair two registers they can have a value between 0 and 65,535. B can be paired with D, D with E and H with L. The A register is paired with F, the flag register, which holds that state of the flags, is paired for only a few instructions.

The instruction "LET" in Basic is equivalent to "LD" — read as "LOAD" — in machine code. The basic instruction "LET A=100" would be "LD A,100" — load A with 100 — in machine code. "LET BC=60,000" is "LD BC,60,000" in machine code. You cannot type those instructions directly into your Spectrum, so if you look in Appendix A of the Sinclair manual you will find under the column marked Z-80 Assembler LD D,N (code 22).

The code can be poked into memory and called from Basic. The N stands for any eight-bit number between 0 and 255 because D is only an eight-bit register. LD DE, NN (code 17) loads DE with the 16-bit number which follows. With an instruction like LD B,100 the translation into decimal numbers is easy, 6 for LD B,N and 100 makes 6 100. For 16-bit registers like HL or BC it is not so easy because you can poke numbers into memory only which are between 0 and 255. The decimal code of LD BC,500 is 1 244 1 (1 for LD BC,NN then 244 1) (244+1×256=500).

RET is a very important instruction and must be put at the end of a machine code program so that it returns to Spectrum Basic. If you do not put that instruction the program will never return to Basic. DEC and INC are similar instructions. DEC decreases the value in the register which follows the and INC increases it, e.g., INC A increases A by 1.



The flag register is very useful; it holds information about the last calculation the processor performed. The most useful information it can tell us is if the result of the last calculation was zero. Using the zero flag an equivalent machine code program or a FOR-NEXT loop can be written as in figure one to produce a delay.

The JR NZ instruction jumps to DEC B if the zero flag is not set (NZ=NOT ZERO). Other similar instructions are:

JR Z,d jump if the zero flag is set.

JR d jump whatever any of the flags are set to.

The d stands for displacement. If you want to jump forward, replace the d

> 'The last register pushed on to the stack will be the first one to be popped off'

with a positive number between 0 and 127. For backward jumps replace d with the number of bytes you want to jump subtracted from 256. That program can be simplified further by the DJNZ instruction which does the DEC B and the JR NZ,d in one, DJNZ works only for register B — see figure two.

If you run figure one or two you will not have much of a delay because machine code is so fast. You can see the limit of the JR,d group of instructions because it can jump a maximum of 128 bytes — in a small routine that would be sufficient — so to jump long distances there is JP NN, which jumps to the address specified by the 16-bit number that follows.

One way to circumvent the fact that you only have eight registers is to use the stack and the Push and Pop instructions; 16-bit registers are pushed on to the stack and popped off. The last register pushed on to the stack will be the first one to be popped off. If, for example, you wanted to interchange the values in DE and HL you could:

PUSH DE (Put value in DE on to the stack).

PUSH HL (Put value in HL on to the stack).

POP DE (Tape the value that was in HL and put it into DE).

POP HL (Take the value that was in DE and put it into HL).

The easiest way to print on to the screen is to use the instruction RST 16 which prints on the screen the character equivalent of the code in the A register. Unfortunately it changes the values in some of the registers so they have to be put on to the stack before the RST 16 instruction and taken off again afterwards if you want the registers to stay as they were before the printing. A program to print the alphabet is shown in figure three.

The only unexplained instruction is CP 90. That compares A to 90 and sets the zero flag if A equals 90, in which case we will have reached Z and do not want to print any more. CP always compares against A and can be compared to any other eight-bit register or eight-bit number. Try keying this program into your Spectrum using the Basic program as explained in chapter 26 of the Spectrum manual.

The decimal codes are entered into DATA statements, i.e., DATA 62, 64, 60, 245. Note that to run this machine code program you need to enter PRINT: RANDOMIZE USR 32500 — or wherever you have put the code. Most other programs do not need PRINT: unless they use RST 16.

The Spectrum sound in Basic is very limited to beeps and clicks. In machine code, however, much more interesting effects can be created, such as slowly rising and falling tones. The programs which follow can be keyed-in as explained in chapter 26 of the Spectrum manual and executed by entering RANDOMIZE USR 32500, or the address of where the code is stored. Figure four is called Warble.

To create sound in machine code you set HL to a high value for a low-pitched sound and vice versa, DE is set to the duration and then the ROM routine at address 949 is called to sound the note. In the Warble program the pitch is set to 500 and the length of each note to 60 and the note is sounded; then HL is set to 750 and the note sounded again. The process is repeated until B equals zero. CALL 949 executes a routine in the Spectrum ROM and as with RST 16 changes the values in some registers; that is why BC has to be put on to the stack.

Try changing B — the number of times the routine is repeated; HL, the pitch of each note; and DE, the length of each note.

The next machine code program, figure five, is called Siren. It gives a smoothly-rising tone by decreasing HL. Note that the registers are pushed on to the stack before calling the ROM routine and popped off in reverse order so that they retain their initial values. If you change DEC HL (Code 43) to INC HL (Code 35) you will get a smoothly-falling tone. Change DE to have the sound to last longer or shorter.

Figure six is a variation on Siren. It makes a sound similar to the Oric zap. It makes a high-pitched beep and that decreases until it has made 200 sounds. It can be used to sound like a laser gun but it sounds slightly like a bird chirping. Experiment with it for a sound which suits you best.

The best way to write a machine code program is first to make a flowchart, then write the program in assembler and, finally, translate the whole thing into decimal ready for poking into memory. Note that not all instructions are possible, such as LD BC, DE, so check that all your instructions are valid.

Decimal code		Z-80 Assembler	Comments
6 200		LD B,200	Load B with the number of times the loop is to be repeated
5	NEXT:	DEC B	Decrease the B register
32 253		JR NZ,NEXT	Jump to DEC B unless B equals 0
201		RET	Return to Basic

Figure 1.

Decimal code		Z-80 Assembler	Comments
6 200		LD B,200	Or any other number 0–255
16 254	NEXT:	DJNZ NEXT	Decrease B and jump back to repeat the instruction again unless B equals 0
201		RET	Return to Basic

Figure 2.

Decimal code		Z-80 Assembler	Comments
62 64		LD A,64	64=Code for one less than the letter A
60	NEXT:	INC A	Increase A
245		PUSH AF	Save AF on the stack
215		RST 16	Print CHRS of value in A
241		POP AF	Retrieve AF from the stack
254 90		CP 90	Compare A with 90(Z)
32 248		JR NZ,NEXT	Jump to INC A if the zero flag is not set
201		RET	Return to the safety of Basic

Figure 3.

Decimal code		Z-80 Assembler	Comments
6 50		LD B,50	Number of repeats
197	NEXT:	PUSH BC	Save BC on the stack
33 244 1		LD HL,500	Load HL with first pitch
17 60 0		LD DE,60	Load DE with duration of each note
205 181 3		CALL 949	Call ROM routine at 949
33 238 2		LD HL,750	Load HL with second pitch
17 60 0		LD DE,60	Load DE with duration again
205 181 3		CALL 949	Call ROM routine
193		POP BC	Retrieve BC from the stack
16 234		DJNZ NEXT	Jump to PUSH BC if B does not equal 0
201		RET	Return to Basic

Figure 4.

Decimal code		Z-80 Assembler	Comments
33 2441		LD HL,500	Load HL with the starting pitch
17 10 0		LD DE,10	Load DE with the duration of each note
6 255		LD B,255	Load B with the number of repeats
229	NEXT:	PUSH HL	Save HL on the stack
213		PUSH DE	Save DE on the stack
197		PUSH BC	Save BC on the stack
205 181 3		CALL 949	Call ROM routine at 949
193		POP BC	Take BC back off the stack
209		POP DE	Take DE back off the stack
225		POP HL	Take HL back off the stack
43		DEC HL	Decrement HL
16 244		DJNZ NEXT	Decrement B and jump to NEXT if the zero flag is not set
201		RET	Return to Basic

Figure 5.

Decimal code		Z-80 Assembler	Comments
33 10 0		LD HL,10	Load HL with starting pitch
17 3 0		LD DE,3	Load DE with duration
6 200		LD B,200	Load B with the number of repeats
229	NEXT:	PUSH HL	Put HL onto the stack
213		PUSH DE	Put DE onto the stack
197		PUSH BC	Put BC onto the stack
205 181 3		CALL 949	Call ROM routine at 949
193		POP BC	Take BC off the stack
209		POP DE	Take DE off the stack
225		POP HL	Take HL off the stack
35		INC HL	Increase HL by one
16 244		DJNZ NEXT	Jump to NEXT if B does not equal 0
201		RET	Return to Basic

Figure 6.

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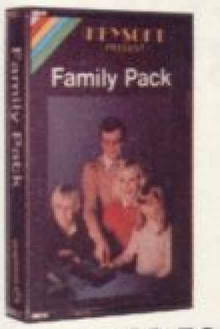
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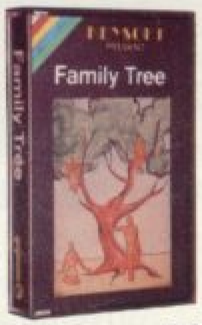
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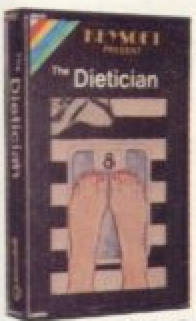
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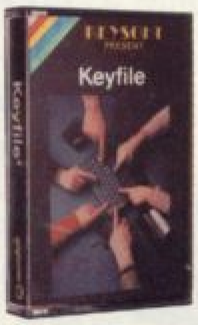
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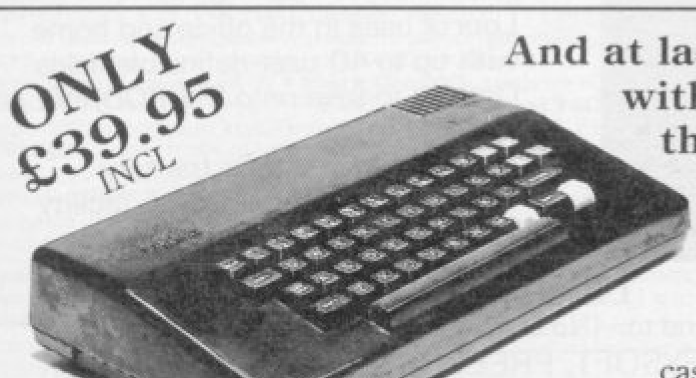
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An easy solution for the winner of our Microdrive

WINNER of the Spectrum Microdrive and Interface One competition in the October issue of *Sinclair User* is Steve Dobb of Arnold, Nottingham. The idea was to run through a computer program into which we had introduced several obvious bugs and some which were not so obvious and to have the program running to produce a code on the screen. Dobb says: "I managed to work out the whole thing in half an hour."

Dobb has been unemployed since he left college last year and has had a Spectrum only since August. The Spectrum is not, however, his first experience of computers, as he took a course in computer studies at college.



The program had several bugs, including a null string in the data statement and a PRINT line disguised as a REM. The FOR. . . NEXT loops were jumbled, and there were too many items of data.

It was not necessary to rewrite the program or to put the lines in the correct order. All that had to be done was to look for the statements which were used to print on to the screen. They included statements to print the characters 61t on the screen which could have been in any order, a fact indicated by the way the program was structured. The puzzle ensured that anyone who found the correct answer would be able to use the Microdrive and Interface One to the best advantage.

When he receives his Microdrive, Dobb will not be thinking about what software he can buy. "I don't think it's worth waiting for Microdrive software to reach the market. It would be a long wait, judging by what is happening at the moment and the scarcity of the devices".

He will be able to use the Interface and Microdrive for three main purposes. First, the Microdrive will enable him to store programs and data and retrieve it quickly. The Interface provides an RS232 connection which can be used to run a large printer or connect to another computer and a network to allow other Spectrums to be linked.

Dobb is one of the few people who have jumped the Sinclair Research mailing list effectively for one of the fast storage devices.

Win three days in Cologne

Currah Computor Components, in association with *Sinclair User,* announces the first great Microspeech competition. We are looking for the best arcade or adventure game using the Currah speech synthesis unit.

First prize is a trip to Cologne for the International Computer Show from June 14–17, 1984. The prize includes airline tickets for two and three nights' accommodation in Cologne. The winner will also receive royalties from the product which Currah Computor Components plans to market. Ten runners-up will each receive a £10 software token.

Games will be judged on use of speech and sound as well as graphics, entertainment value and playability.

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Inside...

Setting new standards in educational software with Sinclair-Macmillan

Plus six other learning programs

TODAY, LEARNING IS A NEW GAME

Subsidised microcomputers are now commonplace as teaching aids for the very youngest children and the ZX Spectrum is prominent amongst those micros at use in schools.

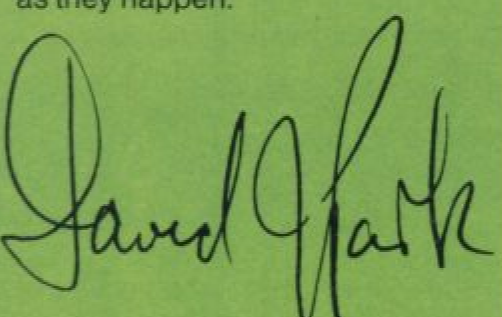
In the relatively short time that the Spectrum has been at work in the classroom, two questions have been answered. Yes: with the right software, the micro can and does teach effectively and thoroughly (and gives teachers more time to devote to individual pupils). Yes: young children think little of working rapidly and successfully, with a screen and keyboard, on even quite complex subjects.

In this Sinclair Special we reveal a range of educational software specifically designed to make full use of these advantages. The programs produced by Sinclair in collaboration with Macmillan Education are fascinating. They deal imaginatively and most effectively with early reading skills and take a truly refreshing approach to basic science.

In the Blackboard range we've programs which bring a light-hearted clarity to the tricky matters of spelling and punctuation.

These programs are designed for use both at home and in the classroom. Each program is accompanied by full documentation which gives parents helpful advice and guidance on the educational objectives.

The programs covered on these pages represent only a fraction of the full and fast-growing list of Spectrum software. Be assured we'll keep you in touch with new developments as they happen.



David Park
Education Marketing Manager

NEW WAYS TO LEARN WITH THE ZX SPECTRUM™

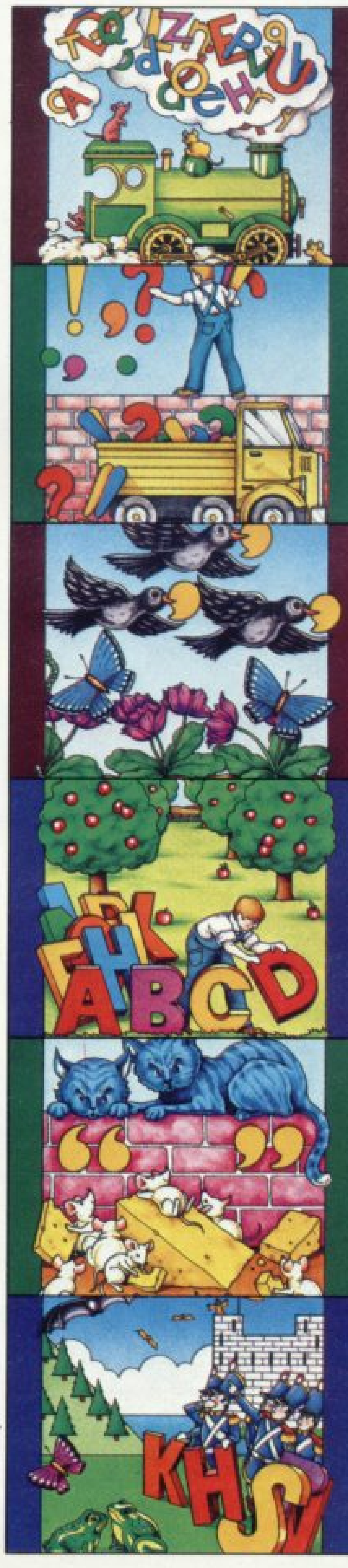
Programs from Blackboard Software

The new range of educational programs from Blackboard Software makes learning an enjoyable process by involving the child in a game which teaches as it entertains.

Each program has a step-by-step example section and gives correct answers after a number of attempts. Vocabulary changes can be made, allowing each program to keep pace with the child's development. This flexibility can also be used in the classroom to cater for children of differing ability.

The instructive and colourful games which follow the successful completion of each group of sentences provide useful practice in letter recognition and increase familiarity with the Spectrum keyboard.

All programs are written for the 48K RAM Spectrum.



Alphabet Games

Three games of letter recognition (using either upper or lower case) to help children learn the alphabet and find their way round the computer keyboard.

Alphagaps — The full alphabet is displayed, along with a second, incomplete version. The child must fill in the missing letters.

Random Rats — Press the letter key that is displayed on the gun to destroy the rats which have invaded the cellar!

Invaders — Stop little green men from landing on Earth by pressing the appropriate letter.

Early Punctuation

While an animated matchstick man marches above displayed sentences the child must decide which punctuation mark is missing and where to insert it. At the touch of a key the matchstick man drops the mark into place. After successful completion of every sentence in the exercise, light relief comes in the form of a bottle-shooting game!

The Apostrophe

As each sentence is displayed, a bird appears with a worm in its beak. The keyboard is used to move the bird and drop the worm into the correct place for the apostrophe. When ten sentences have been corrected, the Grub Game is displayed. Press the correct character to change the grub into a butterfly...before it munches through a flower!

Capital Letters

A program to teach the use of capital letters. Sentences incorporating proper nouns and sentences without opening capitals are displayed. The child inserts the correction by guiding an animated figure to the appropriate letter.

For each correct answer an apple grows on a tree. After ten correct answers the child's skills in recognising letters and using the Spectrum keyboard are needed to save the apples as they fall to the ground.

Speech Marks

A comprehensive program including sentences with one or two sets of speech marks ("inverted commas") and exercises in both direct and reported speech.

Using the Spectrum keyboard, a cursor is used to guide speech marks to the correct position. The program offers three levels of difficulty, with full examples for each section. Guide Max the mouse through a maze, after the correct completion of five sentences from each section, but beware of Persian cats!

Castle Spellerous

A spelling game with ten levels of vocabulary, including words with silent first letters, double letters and other difficult words. The Princess has been captured and carried off to Castle Spellerous. Helped by ten soldiers, the child can attempt a rescue by giving the right answers. Part of a siege tower is built for each correctly spelt word. Mistakes are costly — the wicked wizard appears as a vampire bat, turning the men into frogs, butterflies and bats!

When ten words are spelt correctly the rescue begins and the wizard takes flight.

SINCLAIR + MACMILLAN: A NEW DIMENSION IN EDUCATIONAL PROGRAMS

Sinclair have joined forces with Macmillan Education to produce a completely new and different range of educational software. The results so far can be seen in these exceptional programs.

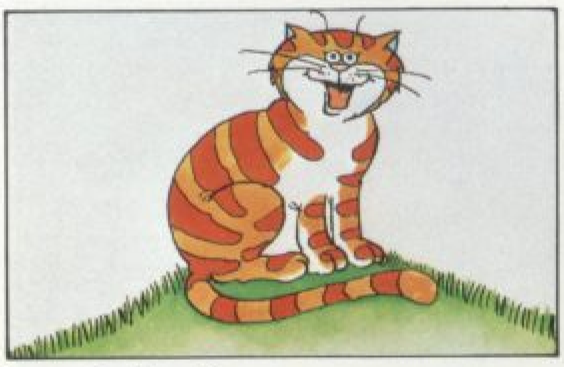
The Learn to Read series is derived from Macmillan Education's best-selling primary school reading scheme, Gay Way. It offers a unique opportunity for parents and teachers to participate in the child's first experience in reading.

Macmillan Education's Science Horizons is one of Britain's most successful school science schemes. Each program concentrates on key scientific ideas and, through simulation of real life, makes the learning process entertaining and enjoyable.



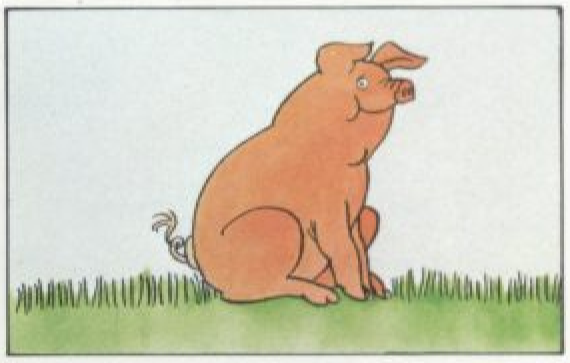
Learn to Read 1

Learn to Read 1 is designed for children who are just beginning to read. It is in four parts, each of which develops skills central to the reading process – letter recognition, sight vocabulary, early spelling and memory. The program is full of colour and fun and children will enjoy learning to read as they meet the animal characters – Ben the dog, Jip the cat and their friends.



Learn to Read 2

Learn to Read 2 extends the fundamental reading skills practised in the first program, as well as encouraging logical thinking. The child's vocabulary is gradually built up as new words such as "red," "green," "car," "ship" and "bus" are introduced. In addition, Learn to Read 2 features an attractive 'reward' system enabling children to see their achievements grow.



Learn to Read 3

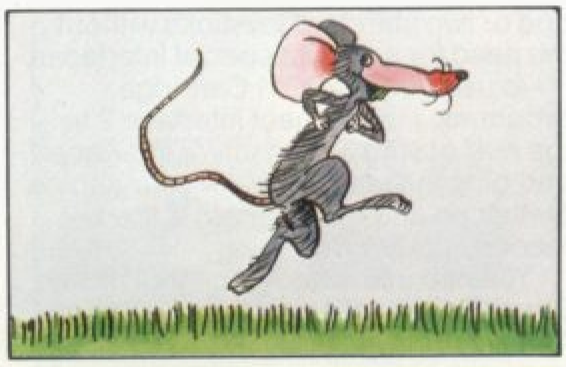
Learn to Read 3 builds on the child's progress so far, so that he or she can gain the confidence to move on through the complex reading process. Learn to Read 3 features four different activities, all of which are colourful and lively. Further vocabulary is introduced until the child is reading more than 30 words.



Learn to Read 4

Learn to Read 4 is the alphabet program in the Learn to Read series.

Using various stimulating activities the program gives the child plenty of practice in working with the alphabet – matching initial letters to words and pictures and spotting missing letters. These exercises build familiarity with simple sequences within the alphabet.



Learn to Read 5

Learn to Read 5 teaches positional language – often difficult to understand and remember – by using words and phrases such as "behind" and "in front of," "inside" and "outside."

The program first demonstrates the meanings of the words using clear pictures. It then tests the child's understanding of the words in two lively games.



Cargo

Set sail around the world. Choose your ports of call – New York, Tokyo, Belem, Helsinki – then the real challenge begins! You must reach your destinations safely, weathering storms on the way. But first, load your cargo – using all your knowledge and skill. Poor loading can mean capsizing and sinking. Your rank, if not your life, is always at stake!



Glider

Be a glider pilot! The glider models real-life gliding conditions so that you can learn through experience. As the pilot you must consider the time of day, the amount of cloud cover and the kind of terrain below you in order to find the up-currents of air that will keep you airborne. Try to fly as far as possible and, when you are high enough, navigate your way back to your home airfield and land safely – if you can.



Survival

Discover what it is like to be an animal in the wild! Be a lion stalking your prey, escaping human hunters. Or be a hawk, mouse or even a butterfly, searching for food and avoiding predators.

Survival models the natural world and brings to life hazards that different creatures must face in their struggle to stay alive.



Magnets

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The strategy is simple: attract smaller magnets to build strength to repel the super-magnet. When cornered, just turn your poles on your enemy and see what happens!

Learn to Read and Science Horizons programs are written for a 48K RAM Spectrum, and are supplied complete with comprehensive supporting documentation for parents and teachers.

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The ZX Interface 2 is the latest new peripheral for the ZX Spectrum system. It enables you to use new ZX ROM cartridge software: plug-in programs that load instantly. There are ten terrific games already available on cartridge. ZX Interface 2 also allows you to use one or two standard joysticks without the need for separate special interfaces.

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Computer facts are made easy for beginners

John Gilbert looks at some new books on machine code and at a lively computer series aimed at youngsters

NO PUBLISHER, until now, has gone to the trouble of providing a range of books on machine code for the beginner and the advanced Z-80 programmer. The situation has been remedied by Interface Publications. It has just released three books, two of which form a series.

The first stand-alone book is *Mastering Machine Code on Your ZX Spectrum* by Toni Baker. Former owners of ZX-81s may notice that the book is an update on *Interfaces ZX-81* machine code book. The contents are similar to the earlier version, although the Spectrum book is longer because of the introduction of extended chapters on printing characters on the screen and an update on advanced features on the Spectrum. There the differences end.

The examples in the text, which usually consist of whole chapters, are the same as in the ZX-81 version. They include a graffiti program which displays the Spectrum character set and three chapters which show how a game of draughts is put together.

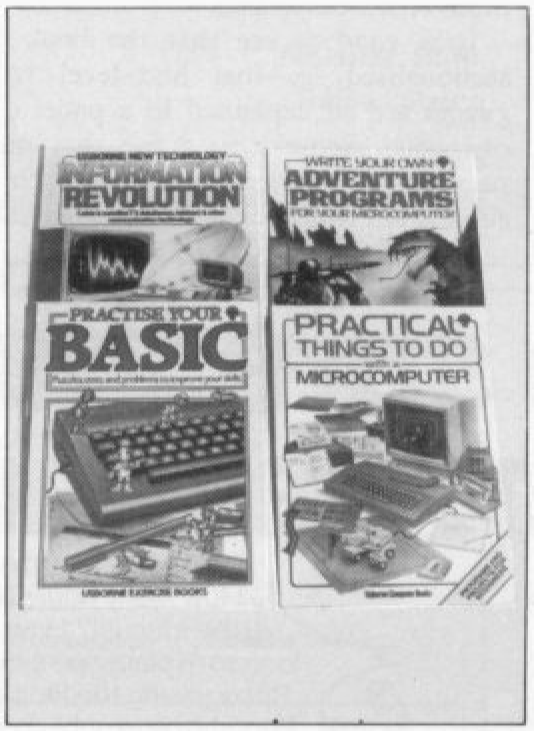
One useful part is a long chapter which provides a dictionary of all the instructions you can give to the Z-80 processor. It turns the book into a useful reference guide which should be of use to all beginners. It will, however, be of little use to advanced programmers — unless they want to brush-up on their terms.

The book is well-produced and you should have few problems with typing-in most of the examples. One small criticism is that a Sinclair ZX printer is used to produce an assembly language listing. All other listings are typeset and that listing sticks out like a sore thumb, as well as being difficult to read in some places.

The book also contains some useful appendices which give tables of conversions between hexadecimal and decimal and also a list of symptoms variables which can be used either in machine code or in Basic programs. *Mastering Machine Code on Your ZX Spectrum* costs £5.95.

The other two books from Interface form a series. *Spectrum Machine Code Made Easy, Volume One* is for the beginner. It is easy to follow and starts, as with most other machine code books, with an introduction to binary and hexadecimal number systems.

The layout of the beginners' book seems to have been thought through carefully, as each chapter deals with one of the major aspects of machine code and, unlike some other books on the market, does not disconcert the reader



by moving into another realm halfway through a chapter.

Most of the aspects of machine code covered in Baker's book are included but this is better as it is easier to read and the layout of text and illustrative examples is better.

The one criticism is that the listings, like Baker's, are sometimes set in type and sometimes listed on the Sinclair printer.

The companion volume is *Spectrum Machine Code Made Easy, Volume Two.* It is for the advanced programmer and takes it for granted that you have some knowledge of machine code. Because of the complexity of jumps, both relative and absolute, in programs and the specialised logical operations, there are separate chapters on those subjects.

That is as far as the book goes along conventional lines, however, as the author, Paul Holmes, explains the use of ports and interrupt modes. They are two subjects which are rarely mentioned in books of this kind.

The ports are dealt with in Basic and machine code and some interesting effects are obtained with sound and colour on the Spectrum.

No previous pure machine code book has dealt with interrupts in the Z-80 system. This one explains the subject easily and competently. The chapter on interrupts justifies what is anyway a good book on machine code and even if you do not buy volume one, which is also excellent, is well worth £5.95, which is the price of each volume.

On a simpler level, Usbourne Books has a new series to back-up its first series of games books for various machines which it launched last year. Six of the books would make excellent presents for young children.

The first is *The Information Revolution.* It contains information about all kinds of devices, including computers, which can be used to communicate from one part of this planet to another, and even into outer space. It looks into the future and examines the introduction of cable communication devices within cities, so that you could see people as well as talk to them on the telephone and do your shopping at home using a computer. Much of what is discussed in this colourful book may seem like science fiction but most of it is available now.

The second book is *Practical Things To Do With A Microcomputer.* It investigates robots, shows how computers create cryptograms or codes, and illustrates how to write programs using almost any computer you might possess.

It will introduce computer technology to a child and, if the child already knows about computers, it should expand horizons even more.

continued on page 130

continued from page 129

Some of the examples may be a little difficult to understand but, with help from parents, children should cope.

Write Your Own Adventure Programs, also from Usbourne, follows in the vein of the previous book. It starts with an introduction to adventuring and shows how to build an adventure program, from the creation of the plot to the programming of the code into the computer.

Unfortunately, Usbourne has stayed with the concept of an adventure game, using dungeons and dragons or haunted castle. It says little of the space adventure or the adventure set at some time in the distant past. Even so, like all the series, the book is well-illustrated and should give most children interested in adventure games a start.

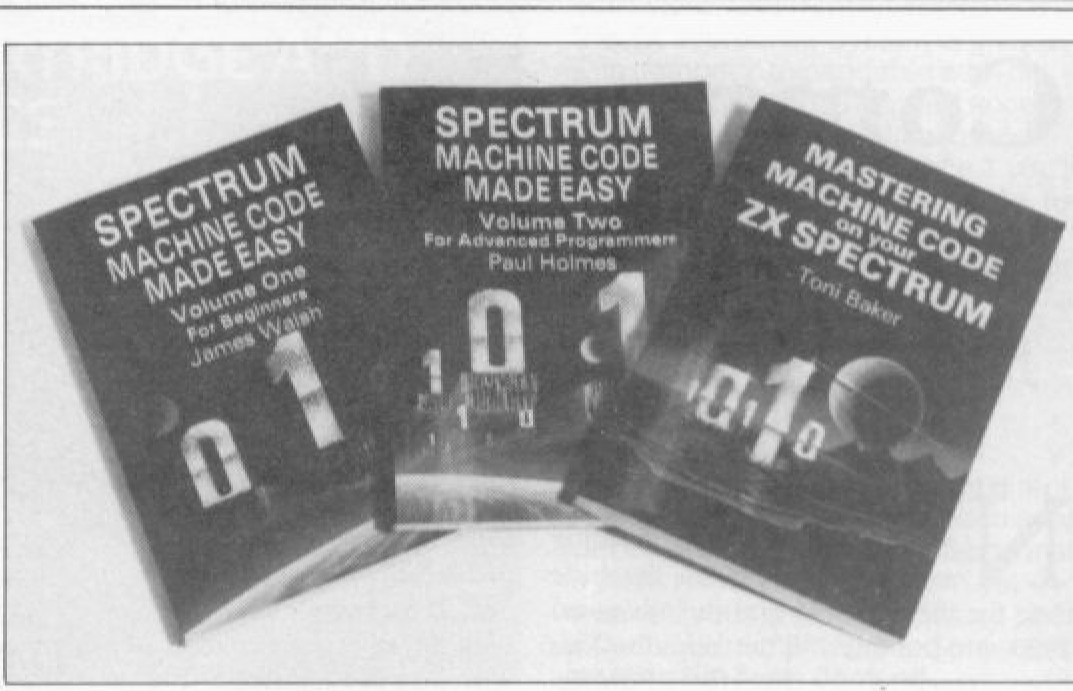
Practise Your Basic takes a young child from the rudiments of the Basic programming language and, using examples, puzzles and tests, tries to give the child some idea of programming technique and the way in which programs should be structured. Most of the programs illustrated are games but the techniques used can be adapted for use in other types of program.

The final book in the series is called *Computer Jargon Illustrated* and is worth its weight in gold. The text and illustrations will take a child step-by-step through the language of computers. It is one of the few books which does not dodge the issue of explaining in plain English what words such as hex or POKE mean and, in some cases, how those terms developed.

It is good to see that the book is sectionalised, so that high-level languages are all explained in a panel on one page. Some may argue that one page is not sufficient to explain such a subject but this book is easy to read and does its job well.

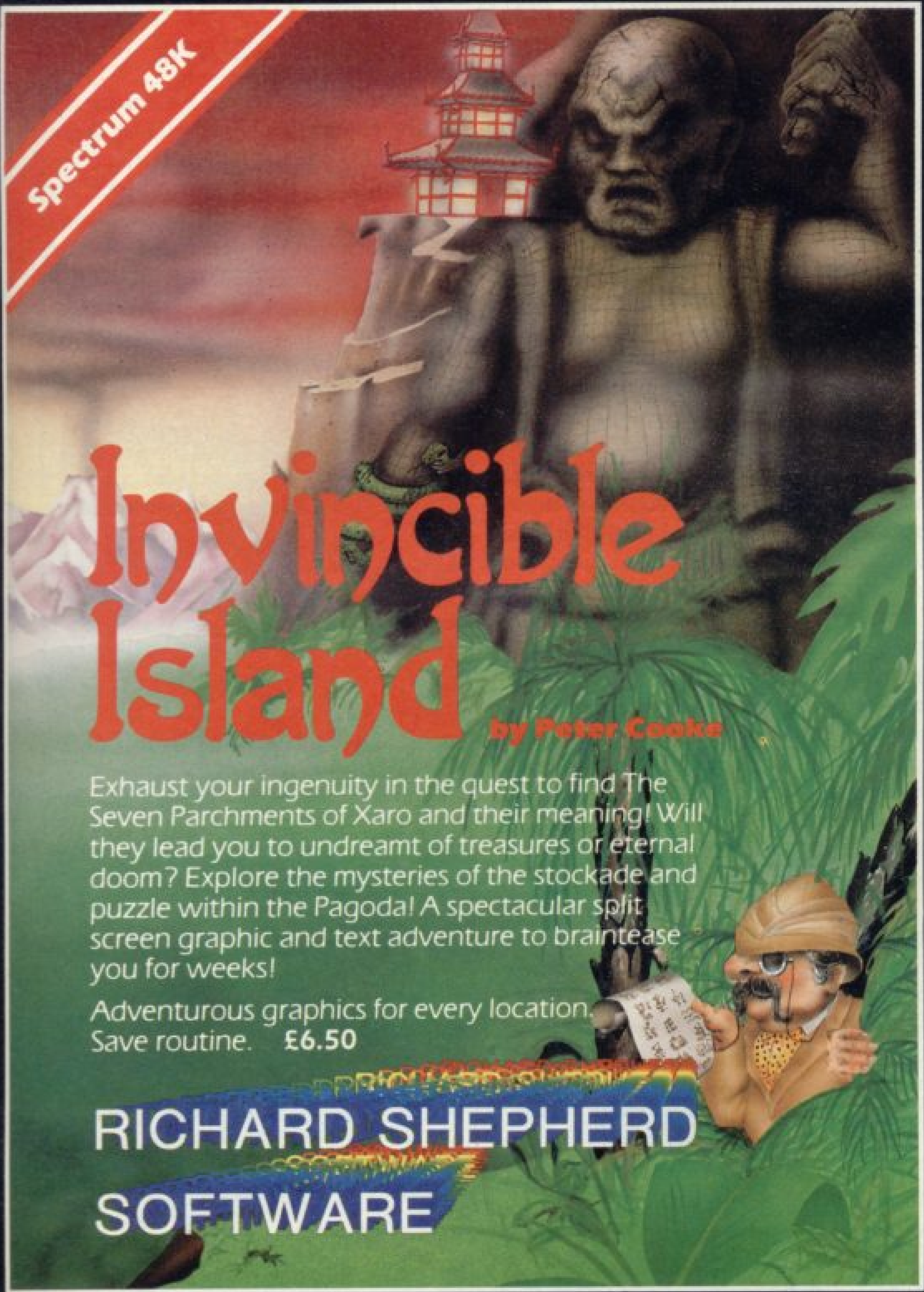
All the books in the Usbourne Series stand out because of the way the text and illustrations merge to form a comprehensive explanation of the subject being discussed. They cost £1.99 each and for the minimal outlay are excellent value. It is good to see that one company at least is trying to educate the younger and next generation in the use of computers.

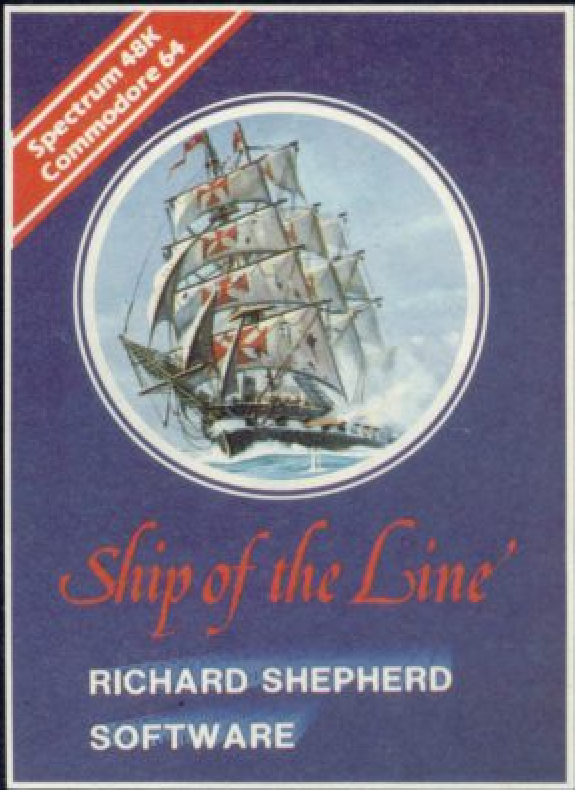
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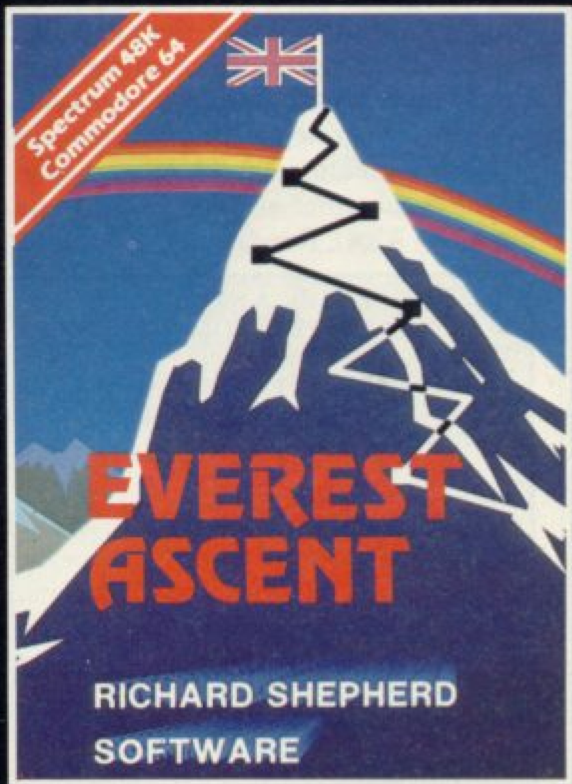
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A simple way to save string variables on tape

Our expert Andrew Hewson offers some hints on storing and tells you how to create new user-defined graphics characters



ONE OF the many useful facilities present on the Spectrum but not on the ZX-81 is the extension to the SAVE command which enables the programmer to SAVE not only programs on cassette but also the screen display, machine code and Basic variables. Unfortunately the syntax of the SAVE command is not so sophisticated as it might be, so that it is possible to SAVE only one variable at a time. It is always possible to SAVE variables one after the other on the same cassette but, as Alex Randall of Chipping Campden points out, that is most inconvenient because the "Start tape, then press any key" message appears each time a new variable is to be SAVEd.

There are several ways round the problem but probably the simplest is to manipulate the variables area in RAM before SAVEing so that it appears to the relevant ROM routines to consist of one large string variable.

Load and RUN the Basic routine listed in table one and enter "HELP-LINE" in response to the input request. The program illustrates the method used to store string variables in memory. The resulting display is shown in table two.

The program works by using the VARS system variable held at 23627 and 23628 to identify the beginning of the variables area in memory. Provided that the program is invoked by entering RUN, the string entered by the user, Z$, lies at the bottom of that area because it is the first variable assigned in the routine. Thus the FOR-NEXT loop PEEKs and PRINTs the memory locations which hold the contents of Z$.

It is clear that strings are stored in memory in straightforward fashion. The first byte of the appropriate area contains the character code of the letter which identifies the string, in this case Z. The next two bytes together specify the length of the string in the form:

String length = PEEK first byte + 256*PEEK second byte

In that case the string contains nine characters and so the first byte is 9 and the second is 0. Hence if we ensure that the first character in the variables area is a string, POKE the length of the entire variables area into the two locations which define the length of the string, and use the SAVE command to store

```
10 INPUT "ENTER A STRING";Z$
20 LET VARS=PEEK 23627+256*PEEK 23628
30 for I=VARS TO VARS+11
40 PRINT PEEK I, CHR$ PEEK I
50 NEXT I
```

Table 1. A Spectrum program which looks at the first few bytes of the variables area of memory.

90	Z
9	
0	?
72	H
69	E
76	L
80	P
45	—
76	L
73	I
78	N
69	E

Table 2. The display which results when the program in table one is RUN and "HELP-LINE" is entered in response to the input request.

```
10 LET Z$=""
20 REM CREATE SOME DATA TO BE SAVED
30 DIM A(2)
40 LET A(1)=32767
50 LET A(2)=65536
60 LET A$="SINCLAIR USER"
100 REM ROUTINE TO SAVE ALL VARIABLES
110 LET V=PEEK 23627+256*PEEK 23628
120 LET L=PEEK 23641+256*PEEK 23642+2-V
130 POKE 23296, INT (L/256)
140 POKE V+1, L-256*INT (L/256)
150 POKE PEEK 23627+256*PEEK 23628+2, PEEK 23296
160 SAVE "ALLVARS" DATA Z$()
170 CLEAR
200 REM ROUTINE TO LOAD ALL VARIABLES
210 LOAD "ALLVARS" DATA Z$()
220 POKE PEEK 23627+256*PEEK 23628,90
230 POKE PEEK 23627+256*PEEK 23628+1,0
240 POKE PEEK 23627+256*PEEK 23628+2,0
300 REM PRINT VARIABLES
310 PRINT "Z$=";Z$
320 PRINT "A(1)="; A(1)
330 PRINT "A(2)="; A(2)
340 PRINT "A$="; A$
350 PRINT "V="; V
360 "L="; L
```

Table 3. Spectrum routines which demonstrate a technique for SAVEing and LOADing all variables.





• *Please address problems and queries to Andrew Hewson, Helpline, Graham Close, Blewbury, Oxfordshire.*

the string on cassette, we will have succeeded in SAVEing all the current variables.

The program in table three demonstrates the technique. Line 10 and lines 110 to 160 are the functional part of the SAVEing routine and lines 210 to 240 are the functional part of the LOADing routine. I have included the remaining lines only to prove that the method works.

The new length for Z$ is calculated by subtracting the value in VARS from the address of the beginning of the Edit Line area, held in the system variable E_LINE at 23641 and 23642. The result is adjusted to take account of the byte occupied by the string identifier, the two bytes occupied by the string length, the byte containing 128 which marks the end of the variables area, and the six bytes which will be required for the variable L which does not exist at the time the calculation takes place.

A circuitous route via a temporary store — I have chosen to use the printer buffer — must be taken to POKE the result into the appropriate locations, because the routine causes all the Basic variables except Z$ to become temporarily inaccessible.

Spectrum Basic permits only numeric or string arrays to be SAVEd — see page 208 of the Spectrum manual — and so the syntax checker will not permit the entry of a line such as:

SAVE "ALLCHARS" DATA Z$

Hence the program SAVEs Z$ as if it were a string array, i.e., in the form Z$(). It is surprising that the SAVE routine in the ROM does not halt with an error report when that line is encountered. The Spectrum distinguishes string arrays from strings in the variables area by adding 128 to the code for the identifying letter. For example, the code for the string Z$ is 90 and the code for the string array Z$() is 90+128=218.

So an inconvenient consequence of SAVEing Z$ as if it were an array is that the contents of the identifying byte is increased by 128. Line 220 in the LOADing routine corrects the value to 90 and lines 230 and 240 re-set the length of Z$ to zero. The remainder of the program demonstrates that the data has all been recovered.

Decimal	Assembly	Comment
42 75 92	LD HL,(23627)	Load HL with address in VARS
126	LD A,(HL)	Copy first byte to A
254 90	CP 90	Compare with 90 (code for Z)
40 2	JR Z,2	Jump if code is 90
207	RST 8	Error detected—return to Basic
27	DEFB 27	with error code "S"
235	EX DE,HL	Copy VARS to DE
42 89 92	LD HL,(23641)	Load HL with address in E_LINE
140	LD BC,4	Load BC with 4
167	AND A	Clear carry flag
237 82	SBC HL,DE	Calculate new length
237 66	SBC HL,BC	for Z$
235	EX DE,HL	and store in DE
35	INC HL	Copy new length
115	LD (HL),E	to the appropriate
35	INC HL	pair of bytes
114	LD (HL),D	in Z$
201	RET	End
42 75 92	LD HL,(23627)	Load HL with address in VARS
126	LD A,(HL)	Copy first byte to A
254 218	CP 218	Compare with code for Z+128
40 2	JR Z,2	and jump if correct value
207	RST 8	Otherwise return to Basic
26	DEFB 26	with error code R
54 90	LD (HL),90	Reset byte to code for Z
35	INC HL	Reset
54 0	LD (HL),0	length
35	ICN HL	of Z$
54 0	LD (HL),0	to zero
201	RET	End

Table 4. Two Spectrum matching code routines for SAVEing and LOADing all variables.

```
10 INPUT "ENTER THE LETTER TO BE REDEFINED"; A$
20 LET A$=CHR$ (CODE A$-32*(A$>"£"))
30 IF A$>"A" OR A$>"U" THEN BEEP .2,24: GOTO 10
40 FOR I=0 TO 7
50 INPUT "ENTER BYTE NUMBER"; J
60 IF J<0 OR J>255 THEN BEEP .2,24: GOTO 50
70 POKE USR A$+I, J
80 NEXT I
```

Table 5. A Spectrum program for defining new user-defined graphics characters.

I seem often to receive a number of letters all on broadly the same topic. This month several readers have expressed interest in the use of graphics characters on the Spectrum. Emmanuel Willems of Brussels wants to know: **How can one re-design the Spectrum letters?** whereas Garry Baker of Hartlepool asks: **How do you get more than 21 high-resolution graphics characters?**

John Row of Warrington has a specific application in mind. He writes: **How can I call up as many as 200 Egyptian hieroglyphs?** I might mention in passing that I never cease to be amazed at the uses to which the million or so Sinclair users are putting their machines. Egyptian hieroglyphs — whatever next?

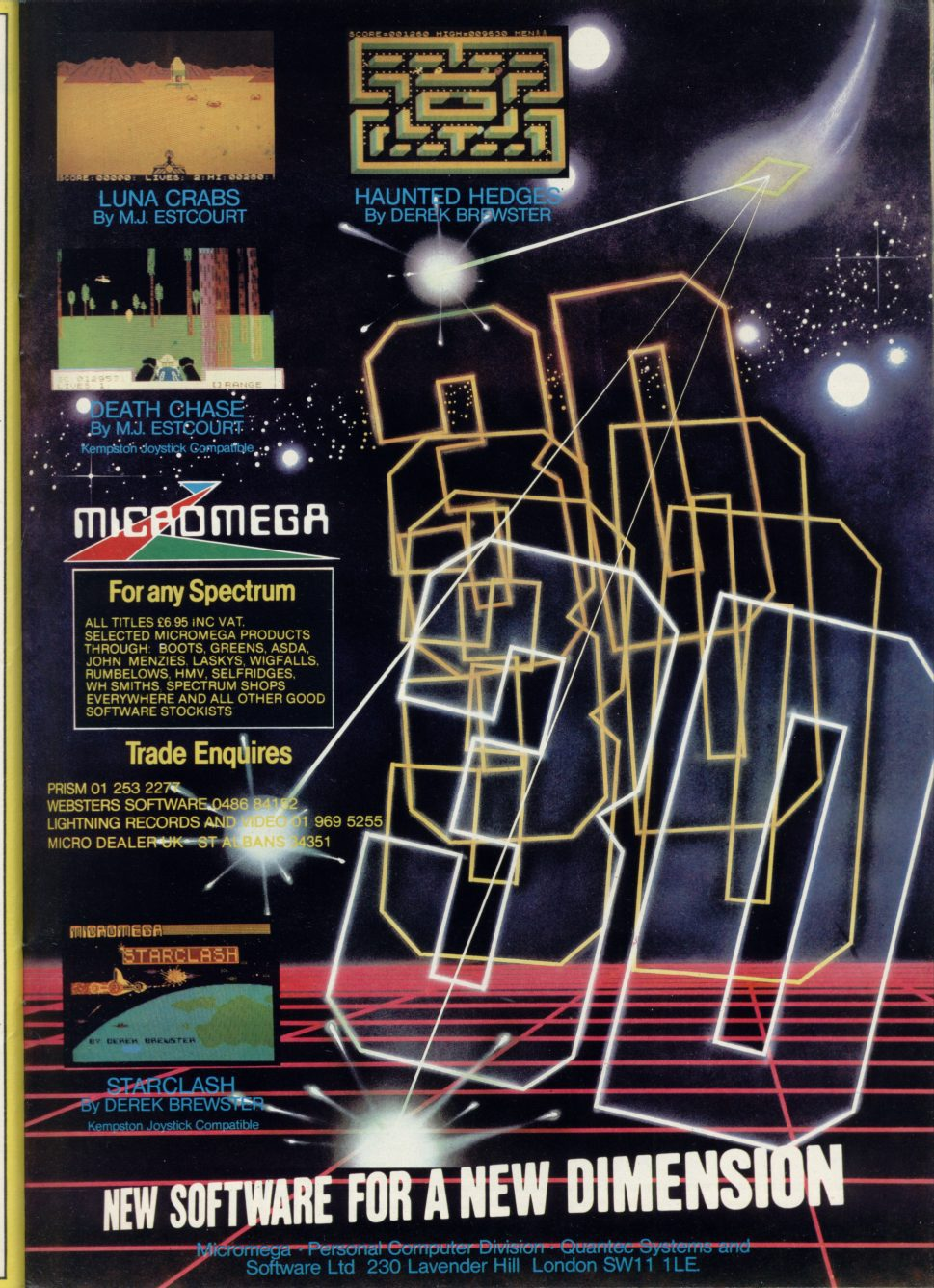
There are two methods for creating new characters, apart from using the DRAW, PLOT and CIRCLE commands which are too slow and cumbersome for most purposes. The simplest is to make use of the user-defined graphics facility in which up to 21 new characters can be defined and assigned, one to each of the letter keys A to U.

The form of each new character is stored in eight bytes of the 168 bytes reserved for the purpose at the top of memory above RAMTOP. The character assigned to a given key can be obtained by pressing the graphics key — CAPS SHIFT 9 — before and after pressing the letter key.

The method of encoding and decoding the eight bytes can be understood with the help of some knowledge of binary numbers. Every character in the Spectrum character set, and every new character created by the user, is defined relative to an eight-by-eight grid. Each element in the grid is called a pixel. Each pixel can be set to either the INK

continued on page 30


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or the PAPER colour and it is the precise arrangement of INK- or PAPER-coloured pixels in the eight-by-eight grid which creates each character.

Each of the eight bytes devoted to a character defines the setting of one horizontal line of eight pixels using the following system. The contents of a byte, which necessarily lies in the range 0 to 255 in decimal, is read as an eight-digit binary number so that there is a one-to-one correspondence between pixels and binary digits. A binary number consists of zeros and ones only. All pixels for which the corresponding binary digit is zero are set to the PAPER colour, whereas all pixels for which the corresponding digit is one are set to the INK colour.

Very often the first and last bytes of the group of eight controlling a given character are zero. Those two bytes determine the top and bottom of the character respectively and a zero setting ensures that all the corresponding pixels are set to the PAPER colour; thus, when the character appears on the screen, it is well-separated from other items on the lines above and below.

For a similar reason each byte usually contains an even number which is also less than 128. As a result, all pixels at the right and left are also set to the PAPER colour, so that the character is distinguished easily from its fellows on either side.

When the Spectrum is first switched on the user-defined graphics characters are set to a copy of the capital letters on the corresponding key, it is a simple matter to alter the characters. Table five lists a Basic program which does the job. I have also listed in table six the numeric codes for the letters in the Greek alphabet.

The system is designed to provide a set of, at most, 21 new characters but additional sets can be defined by altering the UDG systems variable which is held at 23675 and 23676. The number in UDG is the address of the first byte of the first graphics character, i.e., the character assigned to the A key. When the Spectrum is switched on it is set to 32600 — 16K machine — or 65368 — 48K machine — thus reserving 168 bytes for the 21 characters between the UDG address and the top of RAM.

In principle, UDG can be changed to point to any address in RAM but the simplest approach is to reduce it by 168 for each additional character set required. It is also necessary to reduce RAMTOP by a similar amount so that the graphics characters do not interfere with the stack, thereby causing the machine to crash.

RAMTOP normally is set to one less than the value of UDG and the CLEAR instruction must be used to alter it. Thus the procedure to create space for one additional set of graphics characters on the 16K machine is to enter:

CLEAR 32431
POKE 23675,176
POKE 23676,126

The CLEAR command moves RAMTOP down to 32431 and the two POKEs re-set UDG to UDG=176+256*126=32432

That leaves 32768−32432=336 bytes between the address pointed to by UDG and the top of RAM, which is sufficient space for two tables each 168 bytes long.

The user-defined graphics facility is flexible enough for most purposes, despite the limitation to 21 characters per set, but the user should also be aware of the technique for re-defining the ordinary character set. A number of the programs on the market for the Spectrum make use of that facility, because it gives the program more style, including **Star Trek** by Silversoft, **Timegate** by Quicksilva and **3D Space Wars** by — yes, you guessed it — Hewson Consultants.

There are 96 characters in the ordinary Spectrum character set. The set starts with character code 32 — the space or blank character — and ends with the copyright symbol — code 127. They are defined in an analogous fashion to the user-defined characters by a table which is held in ROM at address 15616. Each definition is held in eight bytes and so the table is 768 bytes long.

The address of the beginning of the table is 256 more than the value held in the CHARS system variable which is located at 23606 and 23607. Bearing in mind that the code of the first character in the table is 32 it can be seen that the address of the first of the eight bytes defining a given character is PEEK 23606+256*PEEK 23607+8*character code.

Creating a new character set from scratch is a complicated task because the shape of each letter or digit must be worked out in detail. The best technique is probably to move RAMTOP down by 768 bytes, copy the entire Sinclair character table into the area above RAMTOP, and then re-set CHARS to point to the new area. That is the function of the program in table seven. New characters can then be created as modifications of the Sinclair originals.

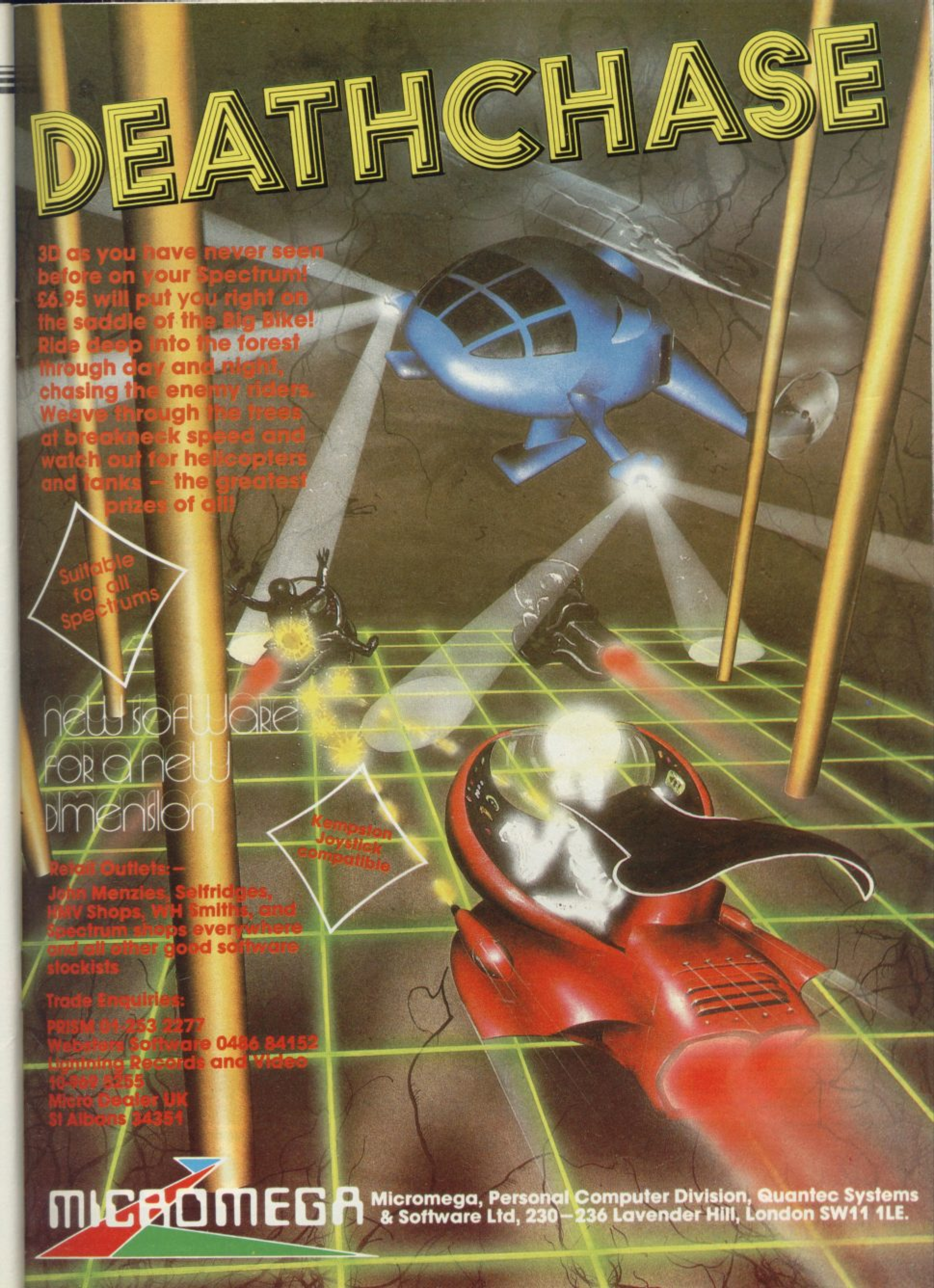
```
10 CLEAR 64599
20 FOR I=0 TO 767
30 POKE 64600+I, PEEK (15616+I)
40 NEXT I
50 POKE 23606, 88
60 POKE 23607, 251
```

Table 7. A 48K Spectrum program to move the character table above RAMTOP and re-set the CHARS system variable to point to the new table. For use on a 16K machine, alter the following lines:

```
10 CLEAR 31831
60 POKE 23607, 123
```

Letter	Lower-case codes								Upper-case codes							
Alpha	0	0	0	56	72	72	60	0	0	16	40	68	124	68	68	0
Beta	0	112	72	112	72	112	64	64	0	120	68	120	68	68	120	0
Gamma	0	0	72	48	32	32	32	0	0	124	68	64	64	64	64	0
Delta	48	64	32	48	72	72	48	0	0	64	96	80	72	68	124	0
Epsilon	0	0	56	64	48	64	56	0	0	124	64	120	64	64	124	0
Zeta	0	56	32	64	64	112	8	48	0	124	8	16	32	64	124	0
Eta	0	0	0	112	72	72	72	8	0	68	68	124	68	68	68	0
Theta	0	48	72	120	72	72	48	0	0	56	68	124	68	68	56	0
Iota	0	32	0	32	32	32	48	0	0	56	16	16	16	16	56	0
Kappa	0	0	72	80	96	80	72	0	0	72	80	96	80	72	68	0
Lamda	0	64	32	16	16	40	72	0	0	64	96	80	72	68	68	0
Mu	0	0	0	72	72	80	32	0	0	68	108	84	68	68	68	0
Nu	0	0	0	72	72	80	32	0	0	68	100	84	76	68	68	0
Xi	0	56	64	112	64	112	8	48	0	124	0	56	0	0	124	0
Omicron	0	0	0	48	72	72	48	0	0	56	68	68	68	68	56	0
Pi	0	0	0	248	80	80	80	0	0	252	72	72	72	72	72	0
Rho	0	0	0	48	72	112	64	64	0	120	68	68	120	64	64	0
Sigma	0	0	0	60	72	72	48	0	0	124	32	16	16	32	124	0
Tau	0	0	0	120	32	32	32	0	0	124	16	16	16	16	16	0
Upsilon	0	0	0	72	72	72	48	0	0	68	40	16	16	16	16	0
Phi	16	16	56	84	84	56	16	16	16	56	84	84	84	84	56	16
Chi	0	0	68	40	16	40	68	0	0	68	40	16	16	40	68	0
Psi	0	0	16	84	84	56	16	16	0	84	84	84	56	16	16	0
Omega	0	0	0	0	84	84	40	0	0	56	68	68	68	40	108	0

Table 6. Eight-byte codes for forming lower- and upper-case Greek characters.



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GLOSSARY

Basic — Beginners' All-purpose Symbolic Instruction Code. A programming language resembling English which is used by beginners because most popular microcomputers have it as standard.
Bug — an error in a program.
EPROM — Erasable Programmable Read-Only Memory. Semi-permanent storage. Information is not erased if the power is turned off in the computer. Programs can be erased by subjecting the memory chips to ultra-violet light. The memory can then be re-programmed using an electrical device called an EPROM blower.
Interface — RS232 and Centronics. A device which enables other computers or add-ons, such as printers, to be connected to the computer. It converts non-standard signals from add-ons to the standard signals of the computer in use.
Kilobyte — (K). A measurement of memory size. Most machines use 16K as a minimum but 48K is generally agreed to be necessary for serious work.
Machine code — an electronic pulse code used by the computer to perform functions and communicate with memory and other devices.
Mnemonics — abbreviated instructions — for example LD for Load — used in machine language programming.
Motherboard — an external printed circuit board which is used like a multi-way plug planner. It enables other printed circuit boards, such as graphics boards and colour boards, to be slotted-in.
Port — a link to the outside world which can be used by programs and the computer.
PCB — printed circuit board. A board which has on it the electronic circuits of the computer.
RAM — Random Access Memory. Information and programs can be stored in this type of memory as electronic pulses which conform to a set of numbers — machine language — in which programs are represented in the computer. When the power is turned off the information will be lost.
ROM — Read Only Memory. Information stored in this type of memory is not lost when the power is switched off.
Software — programs which control the operation of the computer.
Syntax error — a bug caused by incorrect use of a programming language.



Our easy-to-follow guide for new owners

The basic route to a habit-forming hobby

BUYING a Sinclair machine can be the start of a life-time's obsession with home computing. It is easy, however, to become discouraged if everything does not go according to plan from the beginning.

For those with only a little knowledge of computers and their capabilities, the best way to approach the machines is to abandon any ideas for special uses. While the 48K Spectrum is big enough for simple uses in small businesses, the range of Sinclair computers does not contain machines for major uses. It is better to become accustomed to the many facilities and then decide how you wish to use them.

Begin by unpacking your machine, overcoming your surprise at its size and weight and, following the manual, set up the system. If you cannot get the K on the screen, check that everything is plugged into its correct socket and re-set the machine by pulling-out the power plug for one second and try tuning-in again. If still nothing appears, check the power supply unit by shaking it. If it rattles, return it. If it is satisfactory, check your system with that of a friend.

If you have a Spectrum you will have received an introductory booklet which explains what the computer can do and giving detailed instructions on how to set it up. Also included is a fault-finding guide.

Once the K appears you are ready to begin learning about your machine. It can prevent family arguments if you can afford a separate television set for your system. It also makes life easier if you find somewhere to leave your equipment set up permanently. You will find that a few power sockets are needed and a four-way block connector on a short length of extension cable will help to tidy trailing leads.

When using a Spectrum, a television set has to be more finely-tuned than when using a ZX-81 because of the added dimension of colour. If the set is not tuned properly, the colours will look hazy instead of sharp and clear. If no colour can be seen when it is switched on, the power supply or the television set may be at fault.

Some users have experienced some difficulty with some television sets, which include Hitachi, Grundig and Toshiba. Sets which many people have found compatible include the Sony Trinitron, Fidelity and Ferguson. Recent changes in the ULA should make more sets compatible.

The manuals are written in great detail and are reasonably easy to follow. Some of the chapters may not seem immediately relevant but it is worthwhile reading them as you might miss something important.

Patience is needed at that stage to learn the ways in which the computer will accept information. It is tempting to try to enter programs before you are ready but that is likely to lead to errors. For example, words like AND, THEN and AT should not be typed-in letter by letter.

By the time you have reached chapter 11 in the ZX-81 manual and chapter 19 in the Spectrum manual you should have accumulated sufficient knowledge to be

continued on page 136

continued from page 135

able to type-in other people's programs, such as those in *Sinclair User* and *Sinclair Programs*, without too much difficulty.

It is important when using the ZX-81 that it is not jolted. Some of the connections can easily work loose and everything which has been entered will be lost.

The manuals are not to everyone's liking and if you find them difficult to follow a number of books on the market can help you. Find the one which suits you best.

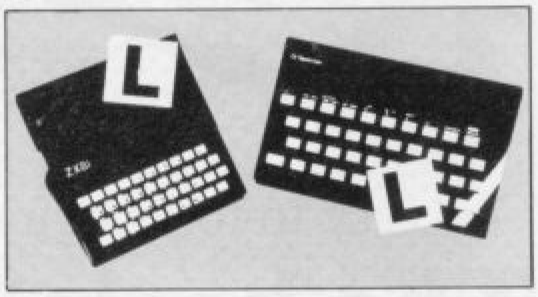
As a way of relaxing you can buy some of the growing range of commercially-produced software. That can be loaded directly from cassette but make sure that your machine is big enough to take the tapes you buy.

For the ZX-81 there are a few tapes for the unexpanded 1K machine but the majority require the 16K RAM pack. Similarly on the Spectrum most companies are taking advantage of the possibilities provided by the larger 48K machine rather than providing cassettes for the 16K.

The tapes can vary in quality and it is advisable to read the reviews in *Sinclair User* and use your judgment to find the best.

An alternative method to learn about both the ZX-81 and the Spectrum is to plunge in at the deep end and see what the machines will do. Refer to the manuals when you have difficulties. You can ignore the functions and calculations initially and experiment with PRINT statements to obtain the feel of the machines.

You may already have heard about the problem involved in SAVEing and



LOADing your own cassettes. The manual gives detailed instructions but many of the early ZX-81s would not accept tapes from some recorders. That problem is said to have been overcome but there can still be difficulties.

Usually they occur when LOADing tapes recorded by other people. One simple method to overcome this is to wind the tape to the middle of the program and type LOAD "" followed by NEWLINE; then increase the volume of the recorder slowly with the tape running until the television screen shows four or five thick black bands. If you then re-wind the tape, the program should LOAD normally.

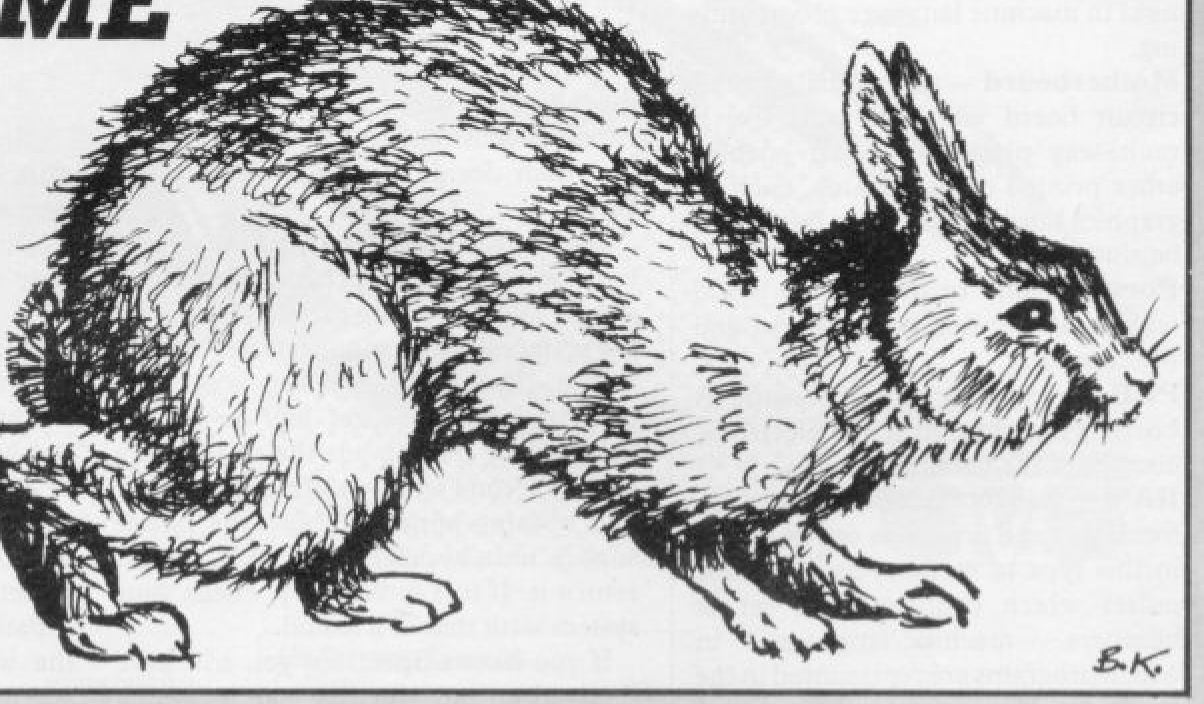
LOADing and SAVEing on the Spectrum is much easier and faster than the ZX-81. One difference is that when SAVEing on the Spectrum the LOAD lead must be disconnected either at the recorder or the Spectrum.

Finally, a health warning. Apart from any practical uses, computing with your Sinclair machine can be a very entertaining hobby and is almost certainly habit-forming. You may easily find yourself crouched over your machine, red-eyed, in the early hours of the morning thinking that in another five minutes you will solve the problem. Try to break that habit by getting into the fresh air and meeting other Sinclair users.

By obtaining a Sinclair computer you find that you have joined a not very exclusive club with many thousands of members, many of whom would be only too happy to advise you if you have difficulties.

Make sure of your regular copies of *Sinclair User* and *Sinclair Programs* and you can be guaranteed many happy hours.

CATCH ME



PLAY **Catch-me** against the clock. See if you can catch the elusive £, avoiding the terrible +, using the cursor keys. **Catch-me** was written for the 1K ZX-81 by Stephen Williams of Swindon, Wilts.

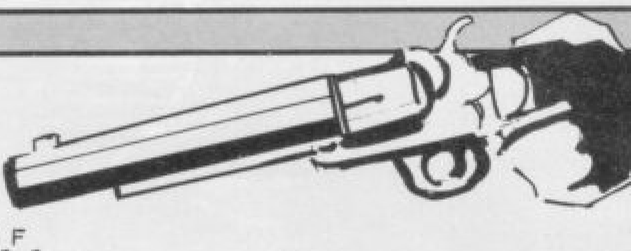
```
10 LET A=5
20 LET B=5
30 LET C=20
40 LET D=20
50 LET E=0
60 PRINT AT C,D;"£"
70 PRINT AT A,B;"(I->"
73 PRINT AT C,A;"+"
74 IF C=A AND A=B THEN LET E=E
+500
75 PRINT AT 0,0;"SCORE";1000-E
76 IF C=A AND A=B THEN GOTO 25
0
78 IF A=C AND B=D THEN GOTO 24
0
80 LET F=INT (RND*5)
90 IF F=1 AND C>0 THEN LET D=D
-1
100 IF F=2 AND D<31 THEN LET D=
D+1
110 IF F=3 AND C<21 THEN LET C=
C+1
120 IF F=4 AND C>0 THEN LET C=C
-1
130 IF INKEY$="5" AND B>0 THEN
LET B=B-1
140 IF INKEY$="6" AND A<21 THEN
LET A=A+1
150 IF INKEY$="7" AND A>0 THEN
LET A=A-1
160 IF INKEY$="8" AND B<31 THEN
LET B=B+1
170 LET E=E+5
180 CLS
190 GOTO 60
210 INPUT F$
220 GOTO 10
240 PRINT AT 6,6;"WELL DONE"
245 STOP
250 PRINT AT 6,6;"GAME OVER"
```

GUN FIGHT

THIS PROGRAM is a gunfight reaction game for two players. Key 0 for the right-hand gun and 1 for the left. The fastest draw is awarded a point and the scores continue to total.

Fighters for the 1K ZX-81 was written by Stephen Buckley of Upper Stoke, Coventry.





```
   1 REM F
   2 LET S=0
   3 LET W=0
   4 CLS
   5 LET N=INT (RND*10)*50
  10 PRINT AT 10,1;"(9e)";AT 11,
1;"(9w 9t)";AT 12,1;"(95)";AT 13
,1;"9w)"
  15 PRINT AT 10,30;"(9r)";AT 11
,29;"(9y 94)";AT 12,30;"(98)";AT
 13,30;"(94)"
  20 PRINT AT 14,13;"READY"
  25 PAUSE N
  35 PRINT AT 15,13;"SHOOT"
  40 IF INKEY$=CHR$ (28) THEN GO
TO 1000
  50 IF INKEY$=CHR$
(29) THEN GO TO 2000
  60 GOTO 40
1000 LET S=S+1
1001 PRINT AT 9,26;S;"WIN"
1002 PAUSE 100
1003 GOTO 4
2000 LET W=W+1
2001 PRINT AT 9,1;W;"WIN"
2002 PAUSE 100
2003 GOTO 4
```

mini squash



MINI-SQUASH is a game written for the 16K ZX-81 by Jason Tuck of Cherry Hinton, Cambridge. Return the ball to destroy the wall in front. If you fail to return the ball you lose a life. You have three lives in all.

```
  10 PRINT
   3 CLS
   4 PRINT "USE KEYS 1 AND 0 TO
MOVE "
  11 PAUSE 200
  12 LET S=0
  14 FOR Y=1 TO 3
  15 LET T=15
  16 CLS
  17 LET E=47
  18 FOR X=T TO E
  19 PLOT X,0
  20 PLOT X,16
  21 NEXT X
  22 FOR F=0 TO 16
  23 PLOT 15,F
  24 PLOT 47,F
  25 NEXT F
  26 LET A=INT (RND*15)+29
  27 LET B=1
  28 LET R=16
  30 LET C=1
  40 LET D=-1
  47 LET TR=2
  48 LET TS=31
  50 PLOT A,B
  52 PLOT TS,TR
  55 UNPLOT A,B
  65 LET A=A+D
  70 LET B=B+C
  75 IF INKEY$="1" THEN LET TS=T
S-1
  77 IF INKEY$="0" THEN LET TS=T
S+1
  78 UNPLOT TS-1,2
  79 UNPLOT TS+1,2
  80 IF B=16 THEN LET C=-1
  85 IF B=16 THEN LET S=S+1
  90 IF B=1 THEN LET C=1
 100 IF A=46 THEN LET D=-1
 106 IF A=TS AND B=TR THEN LET C
=1
 107 IF B<TR THEN GOTO 199
 110 IF A=16 THEN LET D=1
```

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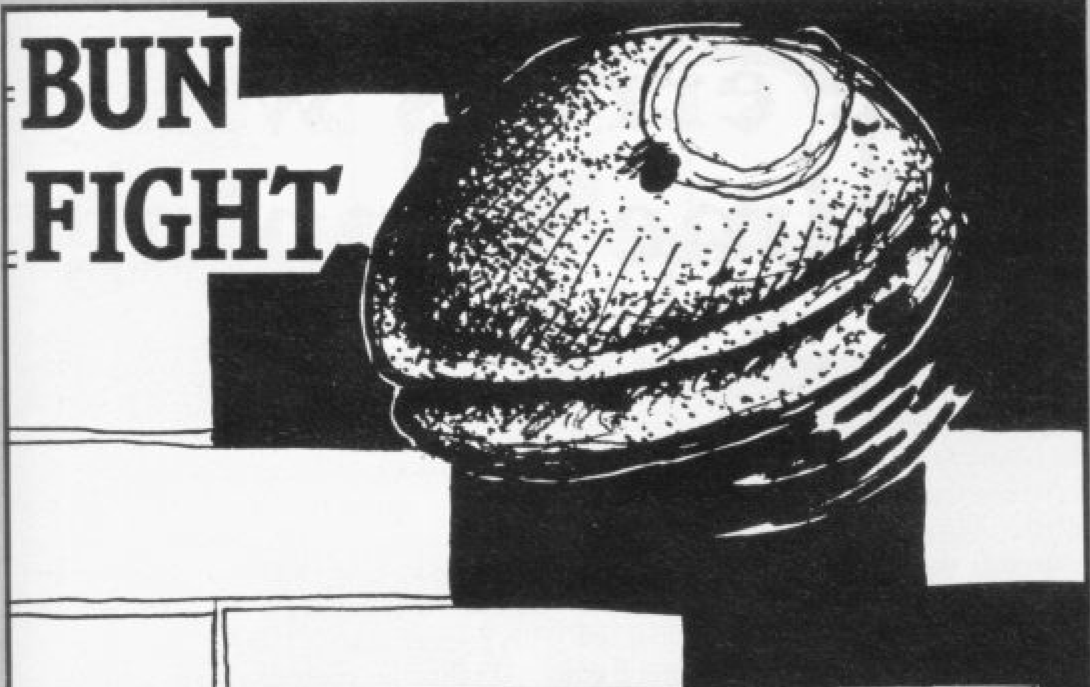
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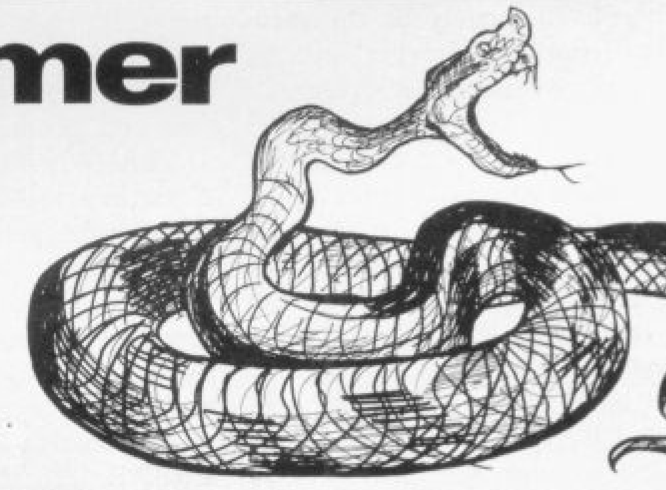
BREAK YOUR WAY out of prison by bouncing your buns off your tray and richochetting them against the walls, which will disintegrate gradually under attack. **Bun Fight** was written for 16K Spectrum by C J Howard of Studley Green, Bucks.

```
  1 LET hi=0: BORDER 5: PAPER 7
 INK 0: CLS
  2 LET sh=1
  3 CLS : GO SUB 200: CLS
  4 FOR f=0 TO 21: PRINT  INK 5
;AT f,0;"(isP)";AT f,31;"(isP)":
 NEXT f
  5 INPUT "Skill (1 to 3. 1 Har
d)";s
 10 LET l=5: LET y=1: LET x=10:
 LET c=5
 20 LET sc=0: LET a=1: LET b=1
 21 FOR f=4 TO 1 STEP -1: FOR g
=1 TO 30: PRINT  PAPER 7; INK f;
AT f+4,g;"(isP)": NEXT g: NEXT f
 25 LET t=ATTR (x,y)-56: IF t<>
0 THEN  LET a=1: LET sc=sc+5-t
 29 PRINT AT 0,4;"Score=";sc,"H
i Score=";hi
 30 PRINT AT x,y;"o"
 35 PRINT AT 21,c;" (g4:inv g3:i
nv g7) "
 40 FOR f=1 TO 5*s: NEXT f
 50 PRINT AT x,y;" "
 60 LET x=x+a: LET y=y+b
 70 IF x<=1 THEN  LET a=1
 80 IF x>=20 THEN  GO SUB 120:
LET a=-1
 90 IF y<=1 THEN  LET b=1
100 IF y>=30 THEN  LET b=-1
103 PRINT AT 21,c;"      "
105 LET c=c+(INKEY$="p" AND c<2
7)-(INKEY$="i" AND c>0)
106 LET c=c+(INKEY$="P" AND c<2
7)-(INKEY$="I" AND c>0)
107 LET c=c+(INKEY$="P" AND c<2
7)-(INKEY$="I" AND c>0)
110 GO TO 25
117 IF sc>(300*sh) THEN  LET sh
=sh+1: LET l=l+1: GO TO 21
120 FOR f=1 TO 3: IF y=c+f THEN
 RETURN
130 NEXT f
140 PRINT AT 21,c;"      ": LET
y=12+INT (RND*5): LET x=9: LET a
=-1: LET b=1: LET c=13: PRINT AT
 15,5;"Missed": FOR f=1 TO 150:
NEXT f: LET l=l-1: IF l>0 THEN
PRINT AT 15,5;"      ": RETURN
150 PRINT AT 15,5;"Game over":
PRINT " Y to play again": PAUSE
0
160 PAUSE 0: IF INKEY$="y" OR I
NKEY$="Y" THEN  GO TO 300
170 BORDER 6: BORDER 1: GO TO 1
70
200 PRINT ''"          **
  **";AT 5,3;"I .....Right";AT
7,3;"P ......Left";AT 10,2;"Caps
 Shift ..Extra speed.": PAUSE 25
0: RETURN
300 IF sc>=hi THEN  LET hi=sc
310 GO TO 2
```

Snake Charmer

ENTICE the snake towards its missing link using the cursor keys. If you guide it accurately the snake will absorb the missing link and elongate.

Snake Charmer was written by Darren Lee (14) of Sutton-on-Sea, Lincs for the 16K Spectrum.



```
  1 PRINT AT 1,10;
 GO SUB 600
  2 DATA 60,126,255,153,153,255
,126,102
  3 FOR f=0 TO 7: READ t: POKE
USR "a"+f,t: NEXT f
  4 LET b$="8": BORDER 1: PAPER
 7: LET c=0: CLS
  5 LET x=10: LET y=19: LET a$=
""
 10 FOR f=10 TO 19: LET a$=a$+"
10"+STR$ f: PRINT  BRIGHT 1; INK
 0;AT 10,f;"a": NEXT f
 20 GO SUB 165
 30 LET z$=INKEY$: IF z$>"4" AN
D z$<"9" THEN  LET b$=z$
 40 LET x=x+(b$="6")-(b$="7"):
LET y=y+(b$="8")-(b$="5")
 45 IF ATTR (x,y)=120 OR x=22 O
R y=32 THEN  GO TO 500
 47 GO SUB 150
 50 LET c$=STR$ x: IF x<10 THEN
 LET c$=" "+STR$ x
 55 LET d$=STR$ y: IF y<10 THEN
 LET d$=" "+STR$ y
 60 LET x1=VAL a$( TO 2): LET y
1=VAL a$(3 TO 4): IF ATTR (x1,y1
)<>120 THEN  GO TO 62
 61 PRINT AT x1,y1;" "
 65 PRINT  BRIGHT 1; INK 0;AT x
,y;"a"
 67 BEEP .01,(LEN a$/10)-20
 70 LET a$=a$+c$+d$: IF c=0 THE
N  LET a$=a$(5 TO )
 75 LET c=c-(c>0)
100 GO TO 30
150 LET f$=SCREEN$ (x,y): IF f$
>"9" OR f$<"1" THEN  RETURN
160 LET c=c+VAL f$
163 BEEP .01,0: BEEP .01,10: BE
EP .01,20
165 PRINT  FLASH 1; BRIGHT 1; P
APER 5;AT (RND*22)-1,(RND*32)-1;
INT (RND*9)+1: RETURN
500 LET x=x-(x=22)+(x=-1): LET
y=y-(y=32)+(y=-1)
505 PRINT AT x,y; FLASH 1;"a";A
T 10,5;"SCORE = ";(LEN a$/4)-10
510 FOR f=20 TO -50 STEP -5: BE
EP .02,f: NEXT f
520 FOR f=1 TO 200: NEXT f
525 IF INKEY$="" THEN  GO TO 52
5
530 CLS : GO TO 4
600 PRINT '" You have to eat th
e flashing    cyan numbers to el
ongate          yourself 'a'"'" Mo
ve using the cursor keys     '5
,6,7,8'";AT 12,0;"  Press any ke
y to begin,"'"  if you are ready
"
601 PAUSE 4E4
610 RETURN
```

Trapping the errors will ensure first-time running

THE FIRST error code encountered by most Sinclair users is the flashing "S" on the ZX-81 or "?" on the Spectrum, which indicates a syntax error in a sentence. Experience and the manual soon show that it is caused usually by typing-in a keyword letter by letter, or by bad punctuation, for example omitting a semi-colon or an inverted comma.

The most frequently-occurring error code is "2" — variable not found. A variable is a letter which has been given a numeric value. When you enter "LET a=2" you are defining a variable. Error code 2 results when the computer reaches a variable in the program to which you have so far given no value.

Check the line which the computer specifies. If it is your program, give a value to the variable or remove it. If you are copying the program, look back in the listing to see which line you have missed.

Although the majority of error codes are explained adequately in the manuals, the report "B-Integer out of range" can be confusing. An integer is a whole number — 1 is an integer, 1.5 and 1½ are not. That code occurs most frequently when you try to print something beyond the limits of the screen.

PRINT AT 0,31; "a" is acceptable and will print a letter "a" at the top right of the screen. PRINT AT 0,32; "a" would not be possible. The integer 32 would be out of range, resulting in error code "B". That would also happen if the computer were instructed to PRINT AT 0,31;"ab". It would still be trying to print a character beyond the limits of the screen.

That error is more difficult to detect if variables have been used as co-ordinates and your character, or series of characters, is being printed in varying positions. If the instruction PRINT AT 0,x;"a" produces report code B, make sure that the value of x never increases beyond 31.

On the Spectrum "B-integer out of range" is also often found when you are POKEing-in user defined graphics. The biggest number which can be POKEd-in this case is 255 or BIN 11111111. In that case the error code will occur in the line containing the POKE statement. In most cases, though, the error will have occurred in one of the DATA lines in the program.

A very frequent error code produced on the Spectrum is "E-Out Of Data". That will occur in a line containing a READ statement. The error code, though, will have occurred in one of the program DATA lines, which may be nowhere near the READ line. A READ command sends the computer to a DATA line to collect the next piece of DATA contained there. That is often done using a FOR, NEXT loop, especially when graphics are being set up.

FOR n=1 TO 8: READ n will send the computer to the DATA lines eight times, for eight separate pieces of information. If there are only seven pieces of DATA there it will return to the READ line and produce the code OUT OF DATA. When there are several DATA lines they will all have to be checked, because the piece of DATA you have omitted was not necessarily the last.

In some cases the computer will follow the program correctly, without producing an error code, but from the programmer's point of view the program contains an error. In that case BREAK into the program at the moment it goes wrong. That will produce report code 9 and the line on which you have STOPped the program. That method makes it easy to locate the area of the program which contains the error.

Programs which you copy from magazines, books or from friends can be difficult to error-trap because they contain programming techniques which you have not yet learned, or simply because it is often difficult to follow another programmer's logic.

The flashing "S" or "?" indicating a syntax error may appear frequently. In that case check carefully what you have copied. You may not have recognised words such as LN or EXP as keywords.

On the ZX-81 especially it is easy to forget that pressing "π" will produce the word PI.

Make sure that when the "is not equal" sign, "<>" appears in a listing you always enter it as one character and not as "is less than", "<" followed by "is greater than", ">".

Technical problems can also cause errors in programs. Any alteration to the power supply can cause a program to CRASH. In that case the screen display may change dramatically and using the keyboard will have no effect. The only solution is to unplug your computer and begin again, making sure that your power supply and RAM pack are both connected firmly. That error is caused by the computer and not by the program.

'The error need not be on the line which produces the report; that is simply the line where the computer meets the problem'

Sometimes a program listing in a book or magazine will contain what seems to be a very obvious error. If it contains key words or symbols which are not on your computer, check that it is intended for your machine. Programs for the Spectrum, the ZX-81 and the ZX-80 are not usually directly interchangeable. If a program contains the command GOTO or GOSUB — a non-existent line number — the computer will simply go to the next numbered line after that one. That is a sign that a program has been developed and improved and is rarely an error.

When you have errors in a program, first check the report codes listed in Appendix B of the manual. It may then be necessary to read the appropriate section of the manual. Remember that the error is not necessarily on the line which produces the report code; that is simply the line where the computer meets the problem for the first time.

Always check carefully every line connected with the line containing the error code and the mistake should be easy to locate.


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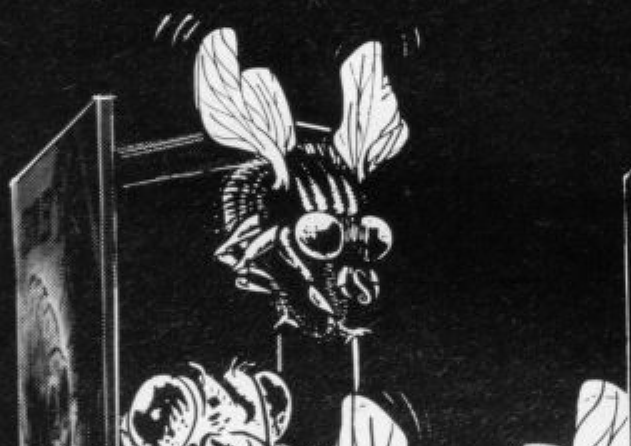


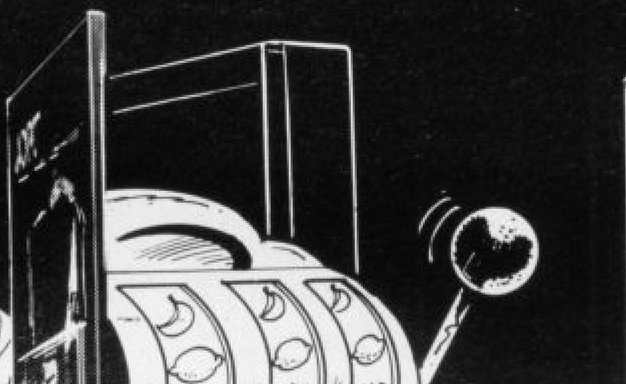
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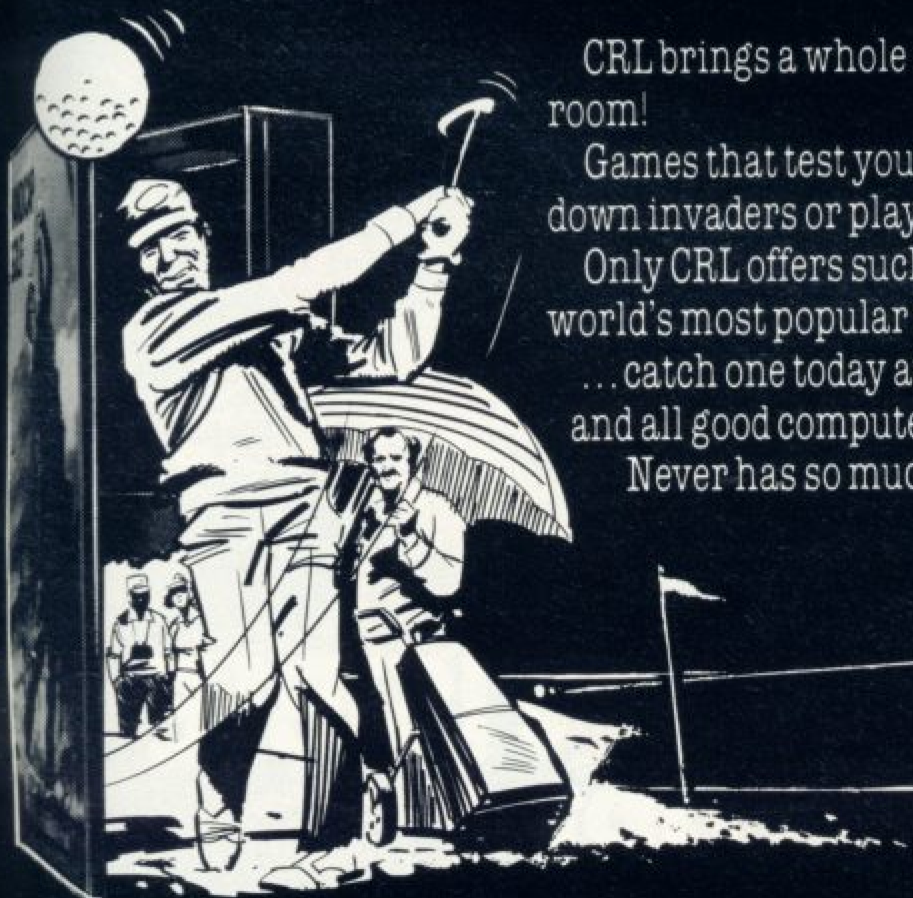




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Expanding the horizons of adventure games

Quentin Heath explores the new possibilities offered by the Microdrive and Interface One

INTRODUCTION of the Microdrive and Interface One has produced an interesting problem for all software houses. What can be done with this new peripheral?

There are few people yet with Microdrives but the problem will increase as sales of the device produce more users. There are several applications in the mind games field, some of which I want to discuss this month.

The adventure game market can benefit from the Microdrive. Games will become more complex as some of the restrictions of the 48K and 16K memory are nullified. It will be possible to create a graphics adventure which will make **The Hobbit** seem crude. Every location in a game could be depicted with screen strings and they could be stored in a central database on which the main program could draw.

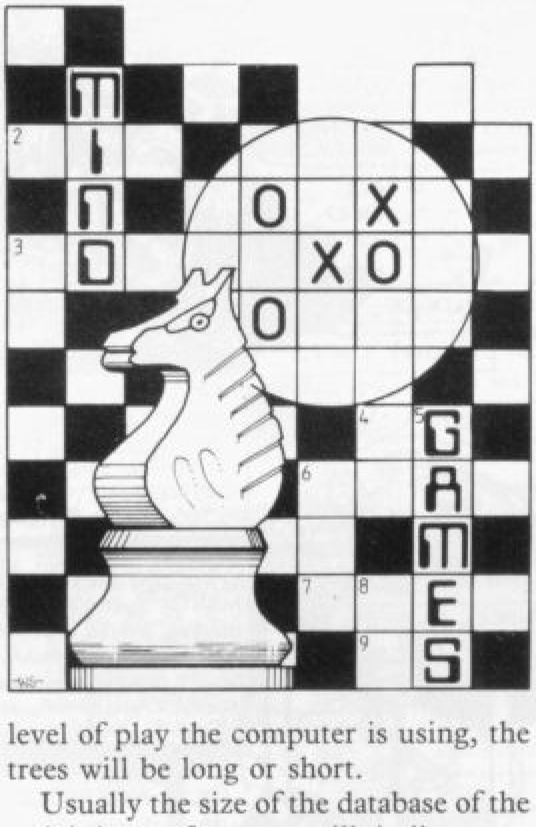
Using the screen string, SCREENS, option the memory storing the main program would not be affected and little memory would be needed to store pictures. At present, storage space for pictures is one of the main problems in graphics adventures such as The Hobbit or **Valhalla.**

The other aspect of adventure programs which makes the Microdrive an ideal device is the response and interpretation databases which permit user and computer to communicate with each other in the language of the adventure. The limited memory capacity available means that few responses to situations can be enclosed. As a result, players often will spend some time looking for the appropriate word or phrase.

There will be no excuse with the Microdrive. It should be possible to store a symbol or phrase table inside the computer and load different sets of phrases from Microdrive into the same space. The benefit of a bigger response database in the program, paged-in when needed, will outweigh the increase in time it takes to obtain an answer from the program.

Unfortunately one of the areas in which the Microdrive will not be able to help is with graphics adventures which use little text and rely on the user moving round a map which has been put on to the screen. It would be possible to extend the number of locations in such an adventure by switching-in new data for every new location or switching parts of program in and out of memory using the Microdrive. The problem is that graphics adventures do not rely on data tables as much as the text adventures. Most parts of the program relate to other parts and cannot be split into blocks to be switched-in from Microdrive.

The Microdrive will also be of use to programmers who want to produce games such as chess, **Othello** or even **Noughts and Crosses.** All those games use data structures which are called tables. Those structures are built during a game and, depending on the



level of play the computer is using, the trees will be long or short.

Usually the size of the database of the weightings of moves will indicate, to some extent, how good the computer is at playing the game. It will use that structure to see what potential moves it has and to point-out possible win situations. That is true of most so-called artificially-intelligent games.

As with all the other items discussed, the size of the database is restricted by memory availability. For that reason corners are cut and new algorithms — methods of solving a problem — have been created. Now tree structures could be made longer and switched in and out of memory when they are needed for reference. That means the computer has more chance of becoming artificially intelligent and beating anything you want to pit against it. It will have all yours and its old games to rely on.

One fly in the ointment is that Microdrive cartridges are in short supply. That should not prove to be a difficulty as the programs do not need to be sold on Microdrive cartridge. The program and its data can be sold on cassette, which can then be put on to a user's Microdrive cartridge. Security of the tape files may be endangered to some extent but there would be the same risk with anything sent out on cassette.

Interface One, the device which attaches the Microdrive to the computer, is possibly more exciting than the Microdrive in its possibilities for adventure writers and players. Using the network you will be able to hook one Spectrum to another and send information between them. That means you could play multi-player adventure games or chess using two or more Spectrums.

With adventure games you could have several players moving round different locations while the computer moves its characters and makes them live. That would be like a super version of The Hobbit. The main difficulty is trying to give the impression that moves can be made by different players at the same time.

Obviously, because of the speed of the network, there will be a delay before inputs can be interpreted and responses from the computer sent out; if we break down each action and share the total time available with the number of players on-line, it should be possible to have a system working.

For instance, the program could accept a command from one user, decode a command from a second user and send a message to a third user in one set cycle. It could then process the first, send the second and decode a command sent by the third. That would happen all the time and is called time-sharing. It is a job which only bigger micros and mainframe computers have done until now. The Spectrum can do it, but slowly.

The Microdrive and Interface One are likely to be important in the development of the mind games market. If you have any other ideas on the subject I would like to hear from you.

Next month I will be delving into the depths of Valhalla, which looks like being another Hobbit.



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BIFF
FDNNG!
MAIM!
OINK
BEEP!
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BAMBOOZLE!
SPLOSH
BONK!
DONG
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ALL-TIME CLASSIC!
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CORKS!
I'VE GOT A SHIP OUTSIDE YOU JUST WON'T BE ABLE TO RESIST!
HOW MUCH?
WELL, 'OW MUCH 'AVE YOU GOT?
A POGO-STICK, A SAXOPHONE AND A CAN OF WORMS
WELL THAT'S 'OW MUCH IT IS! SIGN HERE, HERE AN' HERE!
TATTAH, MUGGINS!
OY! I THOUGHT I'D JUST BOUGHT THAT!
LOOK AT THE LOG-BOOK! IT IS I YOU'VE PAID YOUR HARD-EARNED WORMS FOR! BEEP!
EH, WOT?
WHAT DO YOU KEEP STOPPING FOR?
BEERP! CAR-SICKNESS!
CAR PARK
LEMME OUTTA HERE, YA BUM!
NOW TO RETRIEVE MORRIS SO THAT I CAN SELL HIM TO SOME OTHER MUG! GO, MY PHANTOM PHREAKY BIKERS!
TELEPORT BEAM
I'M FREE! TAKEEEE!!
TOO LATE! THE MAD BIKERS BLAZE IN, LIKE GHOSTS THROUGH THE BRICK WALL...
THIS IS IT
MORRIS meets the Bikers
WATCH OUT FOR.....
CREEPY CARBON MONOXIDE...
LOONY LIFTS
ELEVATOR
PRECIOUS PETROL
...TREACHEROUS TIN-TACKS THAT SLOW HIM DOWN...
GRRR!
AND CLINGING WHEEL CLAMPS THAT BRING HIM TO A GRINDING HALT...
HSSSS
YOW!
AND HAS TO COLLECT TEN GOLDEN COINS BEFORE HE CAN ESCAPE THROUGH THE EXIT TO THE NEXT SCREEN. THERE ARE 9 SCREENS ALTOGETHER, BEFORE HE IS FREE!
MAYBE WE DON'T LIKE THE NOISE HIS HORN MAKES, AN' MAYBE WE CAN'T GET HIM IN THE LIFTS - BUT WE CAN FLY THROUGH WALLS, AN WE DON'T CARE ABOUT NO HAND-SIGGERNALS OR DOUBLE-YELLER LINES! HAR HAR!!
SO WHAT'S AUTOMATA GOT IN THE WAY OF CLASSIC ENTERTAINMENT? HOW ABOUT THE DIFINITIVE VERSION OF THAT BOARD GAME!
HEH HEH...
GO TO JAIL
AND IF YOU CAN'T FIND ANY HUMANS TO PLAY AGAINST, WE DARE YOU TO PLAY YOUR...
..COMPUTER!
BUT BEWARE...
IT MAY WELL WIN!!
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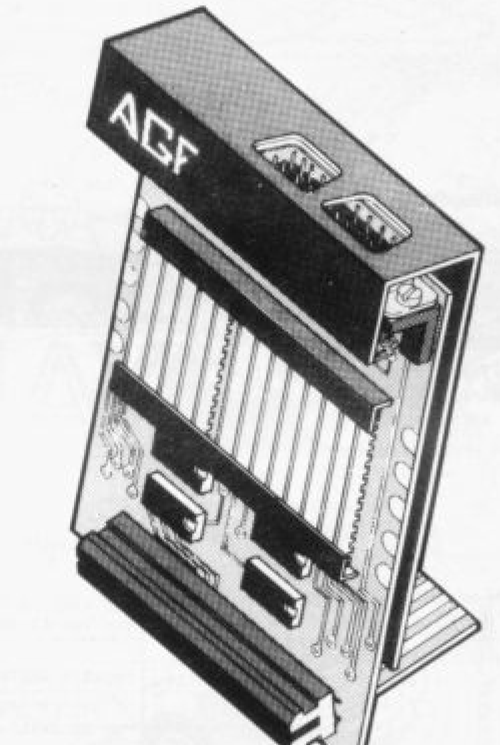
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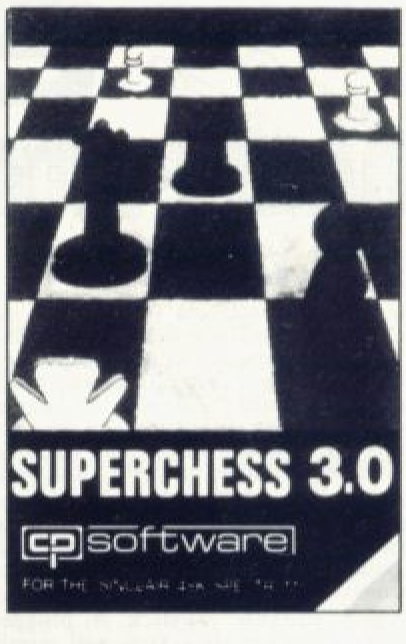
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- RENUMBER — full line renumber with GOSUBs and GOTOs
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10. On Error Goto	27. Uni-Note Sound-Gen	44. Remove Colours	61. Flash Off
11. On Break Goto	28. Dual-Note Sound-Gen	45. Display Memory	62. Bright On
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14. Border Effects	31. Screen Fill	48. Strings to Upper Case	65. Random Number Generator
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SOFTWARE DIRECTORY

OUR comprehensive software listings service has been welcomed by readers. This month we are publishing the full list, updated with the latest releases such as Cyber Zone from Crystal Computing and Hunter Killer from Protek.

If we have reviewed a cassette we have given it a rating known as the Gilbert Factor, named after our software editor John Gilbert. Although the final figure is out of 10 it is the result of a complicated calculation involving a number of factors which are taken into account when assessing how good a cassette is.

The factors include value for money, the layout of the screen instructions, conciseness of the program and its speed of operation, the accomplishment of the task it aims to achieve, the innovation of concept, and the use it makes of the machine.

While trying to ensure that all software is dealt with it is inevitable that some will be omitted. We will remedy any omissions later.

Any suggestions for improvement of the list will be welcomed.

Name	Machine	Company	Type	Gilbert factor
ABC Liftoff	48K Spec.	Longman	Education	*
Abyss	48K Spec.	CCS	Adventure	*
Accounts (Sole Trader)	48K Spec.	Hestacrest	Business	*
Accounts (Limited Company)	48K Spec.	Hestacrest	Business	*
Accounts (Sole Trader)	16K ZX-81	Hestacrest	Business	*
Accounts (Limited company)	16K ZX-81	Hestacrest	Business	*
Address Manager	48K Spec.	OCP	Business	7
Adventure 1	48K Spec.	Abersoft	Adven.	6
Adventure 1	16K ZX-81	Abersoft	Adven.	6
Adventure Isl.	48K Spec.	Contrast	Adven.	*
Airline	16K ZX-81	CCS	Sim.	*
Airline	48K Spec.	CCS	Sim.	*
Airliner	16K Spec.	Protek	Sim.	6
Air Traffic Controller	16K Spec.	Hewson	Sim.	6
Alien Dropout	16K ZX-81	Silversoft	Arcade	*
Allsort S–1	48K Spec.	A Firminger	Utility	7
Alphabet	16K Spec.	Widget	Education	*
Android One	16K Spec.	Vortex	Adven.	*
Ant Attack	48K Spec.	QS	Arcade	8
Apocalypse	48K Spec.	Red Shift	Mind Game	*
Arcadia	16K Spec.	Imagine	Arcade	5
Arcadian	16K Spec.	J K Greye	Arcade	*
Armageddon	48K Spec.	Silversoft	Arcade	*
Aspect	16K Spec.	Bug Byte	Utility	5
Assassin	16K Spec.	Spectrasoft	Arcade	*
Assembler	48K Spec.	Artic	Utility	6
Asteroids	16K ZX-81	Silversoft	Arcade	*
Asteroids	16K ZX-81	Software Farm	Arcade	6
Astral Convoy	16K ZX-81	Vortex	Arcade	*
Astrology	16K Spec.	Stellar Servs.	Utility	7
Astrology	16K ZX-81	Stellar Servs.	Utility	*
Attack on New York	16K Spec.	Fry	Arcade	*
Audio Sonics	16K Spec.	Work Force	Utility	4
Auto Chef	16K Spec.	CCS	Sim.	*
Auto Chef	16K ZX-81	CCS	Sim.	*
Avenger	16K Spec.	Abacus	Arcade	*
Backgammon	48K Spec.	CP	Mind Game	7
Backgammon	16K Spec.	Hewson	Mind Game	*
Ballooning	16K Spec.	Heinemann	Educational	*
Bank Account Syst.	48K Spec.	K Gouldstone	Business	8
Bank Raid	16K ZX-81	J M Senior	Game	*
Barrow Quest	16K ZX-81	Sherry	Adven.	*
Base Invaders	48K Spec.	Work Force	Arcade	6
Battle of Britain	48K Spec.	Microgame	Strat.	*
Battleships	16K ZX-81	JRS	Strat.	*
Beamscan	48K Spec.	Hilderbay	Utility	*
Beamscan	16K ZX-81	Hilderbay	Utility	*
Beamscan	48K Spec.	Beamscan	Utility	8
Beyond Basic	48K Spec.	Sinclair	Utility	*
Big Match Soccer	16K Spec.	Winters	Strat.	*
Biorythms/Pyramids of Egypt	16K Spec.	Spectrasoft	Game	*
Black Crystal	48K Spec.	Carnell	Adven.	7
Black Crystal	16K ZX-81	Carnell	Adven.	7
Black Dwarf's Lair	48K Spec.	Newsoft	Adven.	*
Black Hole	16K Spec.	Quest	Arcade	6
Black Planet	48K Spec.	Phipps	Adven.	7
Blind Alley	16K Spec.	Sunshine	Arcade	7
Brain Damage	48K Spec.	Silversoft	Arcade	*
Breakaway	16K Spec.	Procom	Arcade	*
Brewery	48K Spec.	CCS	Strat.	8
Bridge Master	16K/48K Spec.	Bridge Master	Trad.	9
Bridge Tutor	16K Spec.	CP	Mind Game	*
Bugaboo	48K Spec.	QS	Arcade	7
Bug Blaster	16K Spec.	Crystal Comp.	Arcade	*
Business Bank Account	48K Spec.	Transform	Business	*
Business Bank Account	16K ZX-81	Transform	Business	*
Byter	16K ZX-81	Protek	Arcade	*
Calpac 1	16K Spec.	Calpac	Education	*
Calpac 2	16K Spec.	Calpac	Education	*
Calpac 3	16K Spec.	Calpac	Education	*
Calpac 1	16K ZX-81	Calpac	Education	*
Calpac 2	16K ZX-81	Calpac	Education	*
Car Journey	16K Spec.	Heinemann	Educational	*
Castle Colditz	48K Spec.	Felix	Adven.	*
Castle Colditz	16K ZX-81	Felix	Adven.	*
Caterpillar	16K Spec.	CDS	Arcade	*
Character Gen	16K Spec.	Spectrasoft	Utility	*
Chess Tutor 1	48K Spec.	Sinclair	Educational	*
Chequered Flag	48K Spec.	Sinclair	Arcade	8
Children's Compendium	16K Spec.	Dymond	Game	*
Chuckie Egg	16K Spec.	A and F	Arcade	*
Collector's Pack	48K Spec.	Sinclair	Business	7
Colossal Caves	48K Spec.	CP	Adven.	*
Compiler	48K Spec.	Softek	Utility	6
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Conflict	48K Spec.	Martech	Strat.	*
Conflict	16K ZX-81	Martech	Strat.	7
Countabout	48K Spec.	Longman	Education	*
Countries of the World	16K Spec.	Hewson	Utility	8
Corridors/Genon	48K Spec.	New Gen.	Arcade	9
Cosmic Guerilla	16K Spec.	Crystal Comp	Arcade	8
Counting	16K Spec.	Starter Soft	Education	*
Counting	16K Spec.	Widget	Education	*
Crevasse and Hotfoot	16K Spec.	Microsphere	Games	7
Critical Path Analysis	48K Spec.	Hilderbay	Business	*

Name	Machine	Company	Type	Gilbert factor
Critical Path Analysis	16K ZX-81	Hilderbay	Business	6
Cruising	16K Spec.	Sunshine	Arcade	4
Cyber Rats	16K Spec.	Silversoft	Arcade	7
Cycle Planner	16K Spec.	Medidata	Utility	4
Cyber Zone	48K Spec.	Crystal Comp.	Arcade	*
Dallas	16K Spec.	CCS	Sim.	6
Dallas	16K ZX-81	CCS	Sim.	6
Database	48K Spec.	Microl	Business	7
Demolition	16K ZX-81	Comp. Rntls.	Game	*
Derby Day	48K Spec.	Comp. Rntls.	Game	*
Destroyer	16K Spec.	Winters	Game	*
Devils of Deep	48K Spec.	Shephard	Adven.	*
Dictator	16K Spec.	Bug Byte	Strat.	*
Dietron	16K Spec.	Custom	Utility	6
Disassembler	16K Spec.	dK' Tronics	Utility	7
Display	16K Spec.	Work Force	Utility	*
DIY Book-keeping	48K Spec.	RAMTOP	Business	*
DLAN	48K Spec.	Campbell	Utility	*
Do Not Pass Go	48K Spec.	Work Force	Strat.	6
Do Not Pass Go	16K ZX-81	Work Force	Strat.	*
Door Slammer	16K ZX-81	Cathedral	Arcade	7
Draft	16K ZX-81	Myrmidon	Business	*
Draughts	48K Spec.	CP	Mind Game	7
Dungeons of Doom	16K ZX-81	Woosoft	Adven.	*
Dungeon Master	48K Spec.	Crystal Comp.	Adven.	8
Dymonoids	16K Spec.	Dymond	Game	*
Editor/Assembler	16K Spec.	Picturesque	Utility	8
Educational	16K Spec.	Startersoft	Education	*
Engine Diagnostic	48K Spec.	Spectrasoft	Utility	*
Escape	16K Spec.	New Generation	Maze	8
Espionage Isl.	48K Spec.	Artic	Adven.	5
Espionage Isl.	16K ZX-81	Artic	Adven.	*
Ext	48K Spec.	Abbex	Arcade	6
Everest Ascent	48K Spec.	Shepard	Adven.	6
Evolution	48K Spec.	Microsphere	Game	*
Family Games Pack	16K Spec.	Hornby	Game	*
Farmer	16K Spec.	CCS	Sim.	*
Farmer	16K ZX-81	CCS	Sim.	*
Fighter Pilot	16K ZX-81	Digital Int.	Sim.	5
Finance Manager	16K Spec.	OCP	Business	9
Firework Music	16K Spec.	Soft Cottage	Education	*
Flight Sim.	48K Spec.	Sinclair	Sim.	6
Flight Sim.	16K ZX-81	Sinclair	Sim.	6
Flippit	48K Spec.	Sinclair	Puzzle	7
Football	16K Spec.	Winters	Sim.	*
Football Manager	48K Spec.	Addictive Gms.	Sim.	7
Football Manager	16K ZX-81	Addictive Gms.	Sim.	*
The Forest	48K Spec.	Phipps	Simulation	*
Forth	48K Spec.	Abersoft	Language	9
Forth	48K Spec.	Sinclair	Language	7
Forth	16K ZX-81	Sinclair	Language	7
Four Rules of Number	16K Spec.	Micro Master	Education	*
Four Rules of Number	16K ZX-81	Micro Master	Education	*
FP Compiler	16/48 Spec.	Softek	Utility	9
French Voc Test	16K Spec.	Tutorial	Education	*
French Voc Test	48K Spec.	Tutorial	Education	*
Froggy	16K ZX-81	DJL	Arcade	7
Froggy	16K Spec.	DJL	Arcade	7
Fruit Line	16K Spec.	P A Hanson	Game	*
Fruit Machine	16K Spec.	dK' Tronics	Game	6
Full-screen Breakout	1K ZX-81	New Generation	Arcade	*
Galaxians	16K Spec.	Artic	Arcade	6
Galaxy Conflict	48K Spec.	Martech	Strat.	*
Galaxy Conflict	16K Zx-81	Martech	Strat.	8

Name	Machine	Company	Type	Gilbert factor
Gambling Tape	16K Spec.	Dymond	Game	*
Games	16K ZX-81	P Teakle	Game	*
Games 2	16K ZX-81	JRS	Game	*
Games Tape 1	1K ZX-81	J K Greye	Game	*
Games Tape 2	16K ZX-81	J K Greye	Game	*
Games Tape 3	16K ZX-81	J K Greye	Game	*
Games Pack 1	16K Spec.	A Burnham	Game	*
Games Tape 1	16K Spec.	Sospan	Game	*
Games Tape 2	16K Spec.	Sospan	Game	*
Gangsters	48K Spec.	P Boulton	Strat.	*
General Election	48K Spec.	Bug-Byte	Simulation	*
Ghost Hunt	16K Spec.	PSS	Arcade	*
Gnasher	16K Spec.	R & R	Maze	8
Gobble-a-Ghost	16K Spec.	CDS	Arcade	*
Gobbleman	16K Spec.	Artic	Arcade	*
Gobbleman	16K Zx-81	Artic	Arcade	*
Gobbler	16K ZX-81	Software Farm	Arcade	*
Golden Apple	48K Spec.	Artic	Adven.	7
Golf	16K Spec.	R & R	Sim.	7
Golf	16K Spec.	Virgin	Sim.	8
Gorgon	48K Spec.	Phipps	Adven.	*
Gorilla	16K Spec.	D Hornsby	Game	*
Go To Jail	48K Spec.	Automata	Trad.	*
Grand Prix	16K ZX-81	dK' Tronics	Arcade	*
Graphics	16K ZX-81	IPA	Utility	*
Graphics Toolkit	16K ZX-81	JRS	Utility	9
Great Britain Ltd	48K Spec.	Hessel	Strat.	7
Great Britain Ltd	16K ZX-81	Hessel	Strat.	*
Greedy Gulch	16K ZX-81	Phipps	Adven.	7
Ground Attack	16K Spec.	Silversoft	Arcade	6
Ground Force Zero	16K Spec.	Titan	Arcade	*
Gulp 2	16K ZX-81	Campbell	Arcade	*
Gulpman	16K Spec.	Campbell	Arcade	*
Halls of Things	48K Spec.	Crystal Comp.	Adven.	9
Handwriting	48K Spec.	Chalksoft	Educ.	*
Hanoi King	48K Spec.	Contrast	Mind Game	*
Heathrow	16K Spec.	Hewson	Sim.	8
Hidden Letters	16K Spec.	Poppy	Education	*
High Noon	48K Spec.	Work Force	Arcade	9
High-resolution Invaders	16K ZX-81	Odyssey	Arcade	*
Hitch Hikers' Guide to the Galaxy	48K Spec.	ESP	Adven.	6
Hobbit	48K Spec.	Sin/M.Hse.	Adven.	9
Horace and the Spiders	16K Spec.	Sinclair	Arcade	8
Horace Goes Skiing	16K Spec.	Sinclair	Arcade	8
Hot Dot Spotter	16K Spec.	Longman	Education	*
Hungry Horace	16K Spec.	Sinclair	Arcade	8
Hunter Killer	48K Spec.	Protek	Arc./Adv.	*
I Ching	48K Spec.	Sirius	Game	*
Inca Curse	48K Spec.	Sinclair	Adven.	6
Inca Curse	16K ZX-81	Sinclair	Adven.	*
Inkos	48K Spec.	Chalksoft	Sim.	*
Integration	16K Spec.	University	Utility	8
Integration	16K ZX-81	University	Utility	8
Intermediate English 1	16K Spec.	Rose	Education	*
Intermediate English 1	16K ZX-81	Rose	Education	*
Intermediate English 2	16K Spec.	Rose	Education	*
Intermediate English 2	16K ZX-81	Rose	Education	*
Intermediate Maths 1	16K Spec.	Rose	Education	*
Intermediate Maths 1	16K ZX-81	Rose	Education	*
Intermediate Maths 2	16K Spec.	Rose	Education	*
Intermediate Maths 2	16K ZX-81	Rose	Education	*

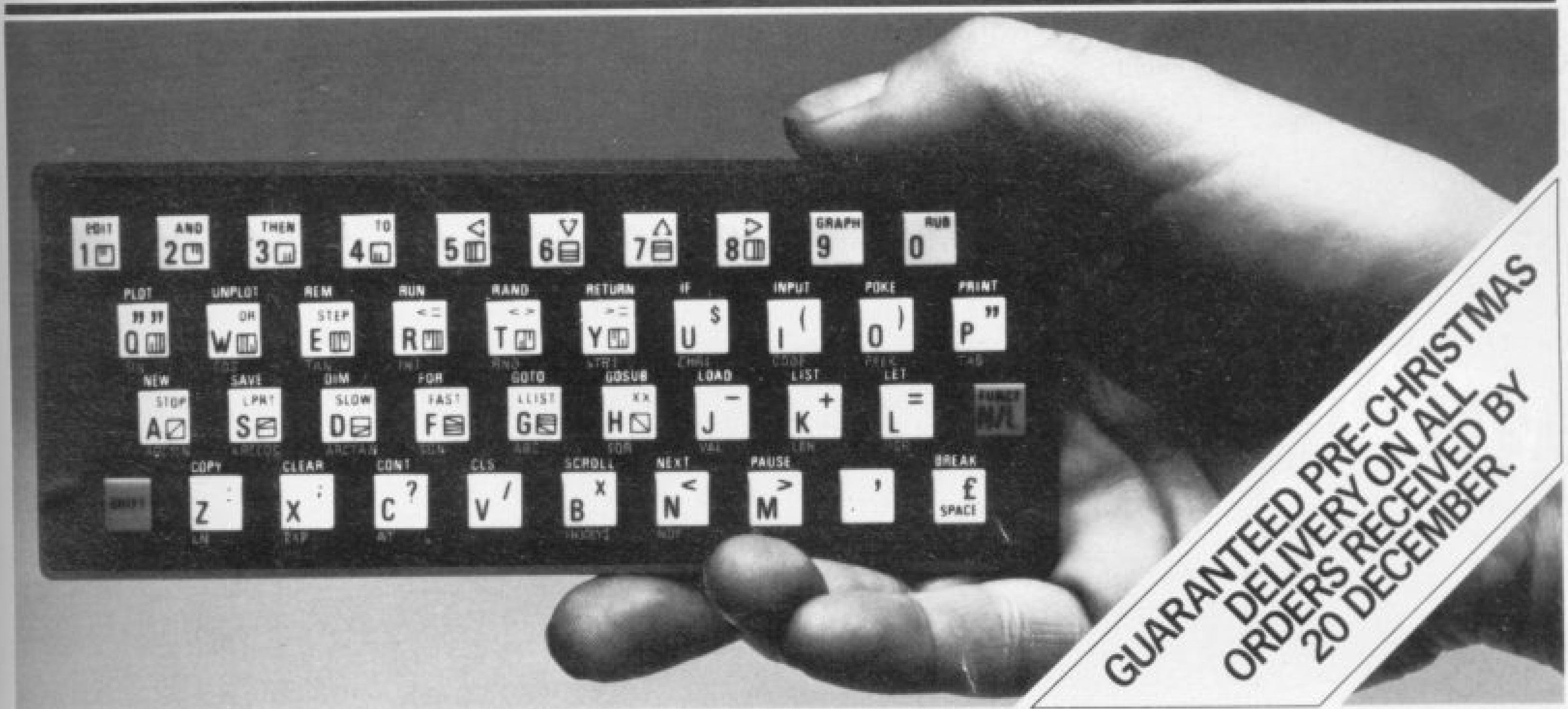
Name	Machine	Company	Type	Gilbert factor
Invaders	16K ZX-81	Abersoft	Arcade	*
Invaders	16K ZX-81	Bug Byte	Arcade	*
Invaders	16K ZX-81	Silversoft	Arcade	*
Invasion Force	16K Spec.	Artic	Arcade	8
Invincible Isl.	48K Spec.	Shephard	Adven.	8
Jackpot	48K Spec.	Comp. Rntls.	Arcade	*
Go To Jail	48K Spec.	Automata	Trad.	*
Johnny Reb	48K Spec.	Lothlorian	Sim.	*
Keysounder	16K Spec.	S and G	Utility	*
Knight's Quest	48K Spec.	Phipps	Adven.	6
Knight's Quest	16K ZX-81	Phipps	Adven.	*
Labyrinth	16K Spec.	Axis	Arcade	4
Language Devel. Series	16K Spec.	Glasson	Education	*
Language Devel. Series	16K ZX-81	Glasson	Education	*
Language Devel. Series	16K ZX-81	Micro Master	Education	*
Language Devel. Series	16K Spec.	Micro Master	Education	*
Lazatron	48K Spec.	Contrast	Arcade	*
Leap Frog	16K Spec.	CDS	Arcade	*
Learning Read 1	16K Spec.	Poppy	Education	*
Linear Progging	16K Spec.	University	Utility	*
Linear Progging	16K ZX-81	University	Utility	*
Lost Island	16K ZX-81	JRS	Adven.	*
Machine Code Test Tool	16K Spec.	OCP	Utility	7
Machine Code Test Tool	16K ZX-81	OCP	Utility	*
Mad Martha	48K Spec.	Miko-Gen	Adven.	7
Magic Mountain	16K ZX-81	Phipps	Adven.	*
Make-a-Chip	48K Spec.	Sinclair	Educational	*
Mailing List	16K ZX-81	Hestacrest	Business	*
Masterfile	48K Spec.	Campbell	Business	8
Masterfile 16	16K Spec.	Campbell	Business	*
Matcalc	16K Spec.	Work Force	Utility	*
Maths Tutor	16K Spec.	AD Software	Education	*
Matrix Operations	16K ZX-81	University	Utility	7
Matrix Operations	16K Spec.	University	Utility	7
Maze Chase	16K Spec.	Hewson	Arcade	8
Maze Death Race	48K Spec.	PSS	Arcade	*
Maze Death Race	16K ZX-81	PSS	Arcade	*
Maze Man	16K ZX-81	Abersoft	Arcade	*
Maziacs	48K Spec.	dK' Tronics	Arcade	8
Mazogs	16K ZX-81	Bug Byte	Arcade	*
MCoder	16K Spec.	PSS	Utility	8
MCoder	16K ZX-81	PSS	Utility	8
Melbourne Draw	48K Spec.	Melbourne Hse.	Utility	7
Merchant of Venus	16K ZX-81	Crystal	Adven.	7
Meteoroids	16K Spec.	dK' Tronics	Arcade	*
Meteoroids	16K Spec.	Softek	Arcade	6
Meteor Storm	16K Spec.	Quicksilva	Arcade	7
Micropen	16K Spec.	Contrast	Utility	*
Mined Out	16K Spec.	Quicksilva	Arcade	7
Mines of Saturn/ Return to Earth	16K Spec.	Mikro-Gen	Adven.	*
Money	16K Spec.	Poppy	Education	*
Monitor/Diss.	48K Spec.	Sinclair	Utility	8
Muncher	16K Spec.	Silversoft	Arcade	*
Muncher	16K ZX-81	Silversoft	Arcade	*
Music Master	48K Spec.	Sinclair	Educational	*
Namtir Raiders	16K ZX-81	Artic	Arcade	8
Night Gunner	16K ZX-81	Digital	Sim.	5
NightFlite	16K Spec.	Hewson	Sim.	5
Nowotnik Puzzle	16K Spec.	Phipps	Game	7
Nowotnik Puzzle	16K ZX-81	Phipps	Game	*

Name	Machine	Company	Type	Gilbert factor
Odds-on	16K Spec.	RSD	Game	*
O Level Chemistry	48K Spec.	Calpac	Education	*
O Level Chemistry	16K ZX-81	Calpac	Education	*
O Level Fench Revision	16K ZX-81	Rose	Education	*
O Level Maths Revision	16K ZX-81	Rose	Education	*
O Level Physics	16K Spec.	Homestudy	Education	*
O Level Physics	48K Spec.	Think Tank	Education	*
Omnicalc	48K Spec.	Microsphere	Business	9
Orbiter	16K Spec.	Silversoft	Arcade	7
Original Superchess	48K Spec.	CP Software	Tradtitional	*
Original Superchess	16K ZX-81	CP Software	Traditional	*
Ostron	16K Spec.	Softek	Arcade	*
Othello	16K Spec.	CP Software	Traditional	*
Othello	16K Spec.	M.O.I.	Traditional	*
Othello	16K ZX-81	M.O.I.	Traditional	*
Pascal Compiler	48K Spec.	Hi-Soft	Language	*
Pathfinder	16K Spec.	Widget	Education	*
Payroll	48K Spec.	Hilderbay	Business	9
Payroll	16K ZX-81	Hilderbay	Business	*
Payroll	32K ZX-81	Soft Tech	Business	*
Payroll	48K ZX-81	Soft Tech	Business	*
Peek	16K Spec.	Zen	Utility	*
Penetrator	48K Spec.	Mel. Hse.	Arcade	7
Personal Banking System	48K Spec.	Hilton	Business	*
Personal Banking System	16K ZX-81	Hilton	Business	*
Pharoah's Tomb	16K ZX-81	Phipps	Adven.	*
Pilot	16K ZX-81	Hewson	Adventure	7
Pimania	16K ZX-81	Automata	Adventure	*
Pimania	48K Spec.	Automata	Simulation	7
Pinball	16K Spec.	Winters	Game	*
Pirate	48K Spec.	Chalksoft	Educ.	*
Pitman Seven	16K Spec.	Visions	Adven.	*
Planet of Death	16K Spec.	Artic	Adven.	6
Planetoids	16K Spec.	Sinclair	Arcade	8
Polynomials	16K Spec.	University	Utility	8
Polynomials	16K ZX-81	University	Utility	
Pool	16K Spec.	Bug Byte	Game	7
Pre/early school cassettes	16K Spec.	Essex	Education	*
Primary Arithmetic	16K Spec.	Rose	Education	*
Primary Arithmetic	16K ZX-81	Rose	Education	*
Print Shop	16K Spec.	CCS	Simulation	8
Print Shop	16K ZX-81	CCS	Simulation	*
Print Utilities	16K Spec.	Sinclair	Utility	*
Pro-Golf	16K Spec.	Hornby	Game	7
Programmer's Dream	16K Spec.	Work Force	Utility	8
Programme Enhancement Package	16K ZX-81	R and R	Utility	*
Puckman	16K ZX-81	Hewson	Arcade	*
Punctuation Pete	16K Spec.	Heinemann	Educational	*
Purchase Ledger	16K ZX-81	Hestacrest	Business	*
Quest	48K Spec.	Hewson	Adven.	6
Ramopoly	48K Spec.	J Fletcher	Game	*
Red Weed	48K Spec.	Lothlorian	Simulation	*
Regression	16K Spec.	University	Utility	8
Regression	16K ZX-81	University	Utility	*
Renumber Delete	16K Spec.	Work Force	Utility	*
Renumber Delete	16K ZX-81	Work Force	Utility	*
Repulsar	16K Spec.	Softek	Arcade	*
Rescue	48K Spec.	Computer Rent	Arcade	*
Reversi	16K Spec.	Sinclair	Traditional	8
Roulette	16K Spec.	Newsoft	Traditional	*
Roulette	48K Spec.	Dymond	Traditional	*
Sales Day Book	48K Spec.	Transform	Business	*
Sales Day Book	16K ZX-81	Transform	Business	*
Sales Ledger	16K ZX-81	Hestacrest	Business	*

Cassette Round-up

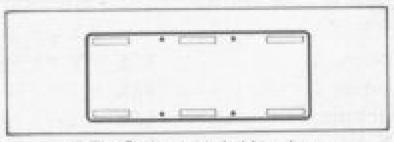
Name	Machine	Company	Type	Gilbert factor
Secret Valley	16K Spec.	Newsoft	Adven.	*
Secret Valley	16K ZX-81	Newsoft	Adven.	*
Self-teach Program	16K Spec.	Anvil	Education	*
Self-teach Program	16K ZX-81	Anvil	Education	*
Sentinel	16K Spec.	Abacus	Arcade	*
Serpents Tomb	16K ZX-81	Vortex	Adven.	*
The Settler	16K Spec.	BSS	Utility	*
The Settler	16K ZX-81	BSS	Utility	*
Shape Sorter	16K Spec.	Widget	Education	*
Sideways Copy	16K ZX-81	D King	Utility	*
Sheepwalk	48K Spec.	Virgin	Game	7
Sheer Panic	16K Spec.	Visions	Arcade	7
Ship of Doom	48K Spec.	Artic	Adven.	7
Shiva Special 1	16K Spec.	Shiva	Games	*
Shopping List	16K Spec.	SD	Utility	*
Sky Raider	16K Spec.	C M Smith	Arcade	*
Slippery Sid	16K Spec.	Silversoft	Arcade	8
Slow Loader	16K Spec.	ELR	Utility	9
Snail Logo	48K Spec.	CP	Language	*
Snail Logo	48K Spec.	CP	Educ/Lang.	7
Snooker	16K Spec.	Visions	Arcade	*
Softalk 1	48K Spec.	CP	Utility	*
Softalk 2	48K Spec.	CP	Utility	*
Solaris	48K Spec.	Sotel	Arcade	*
Solo Whist	16K Spec.	Video Soft.	Traditional	*
Sound FX	16K Spec.	dK' Tronics	Utility	6
Space Fighter	16K Spec.	Winters	Arcade	*
Space Intruders	16K Spec.	QS	Arcade	7
Space Lanes	16K Spec.	Cathedral	Arcade	*
Space Raiders	16K Spec.	Sinclair	Arcade	6
Space Raiders	16K ZX-81	Sinclair	Arcade	*
Space Trek	16K ZX-81	JRS	Arcade	*
Space Zombies	16K Spec.	Mikro-Gen	Arcade	*
Spanish Gold	48K Spec.	Chalksoft	Education	*
Speak and Spell	48K Spec.	S and G	Education	*
Special Agent	16K Spec.	Heinemann	Educational	*
Spec. Assembler	48K Spec.	Artic	Utility	*
Spec. Bug	16K Spec.	Artic	Utility	*
Spec. Tape Copier	16K Spec.	S Giza	Utility	*
Spectadraw 2	48K Spec.	McAlley	Utility	*
Spectipede	16K Spec.	R and R	Arcade	8
Spectral Panic	16K Spec.	Hewson	Arcade	5
Spec. Compiler	48k Spec.	Softek	Utility	7
Spec. Editor/ Assembler	16K Spec.	Picturesque	Utility	8
Spec. Forth	48K Spec.	Abersoft	Language	9
Spec. Forth	48K Spec.	CP	Utililty	*
Spec. Frogs/ Showdown	16K Spec.	Artic	Arcade	*
Spec. Gobbleman	16K Spec.		Arcade	*
Spec. Invaders	16K Spec.	Artic	Arcade	*
Spec. Invasion Force	16K Spec.	Artic	Arcade	*
Spec. Microchess	16K Spec.	Artic	Traditional	*
Spec. Monitor	16K Spec.	Picturesque	Utility	8
Spec. Scramble	16K Spec.	Work Force	Arcade	7
Spec. Sound	16K Spec.	M Afzal	Utility	*
Spellbin	16K Spec.	Startersoft	Education	*
Splat	48K Spec.	Incentive	Arcade	8
Spookyman	16K Spec.	Abbex	Arcade	7
Spreadsheet	48K Spec.	Microl	Business	7
Star Gazer	48K Spec.	CRL	Utility	8
Superchess II	48K Spec.	CP	Traditional	8
Supercode	16/48K Spec.	CP	Utility	*
Super Play I	16K Spec.	Video	Games	*
Superspy	48K Spec.	Shepherd	Adven.	5
3D Strategy	48K Spec.	QS	Mind Games	9
Tai	16K ZX-81	PSS	Game	*
Tank Battle	16K Spec.	dK' Tronics	Game	8
Tape Breaker	16K Spec.	Spectrasoft	Utility	*
Tasword	48K Spec.	Tasman	Business	8
Tasworld II	48K Spec.	Tasman	Business	9
Teacheraid	16K Spec.	B Farris	Education	*
Teach Data	48K Spec.	B Farris	Education	*
Teacher Data	48K Spec.	Farris	Utility	7
Tennis	16K Spec.	Winters	Game	*
Tenpin	16K ZX-81	Phipps	Game	*
Test Match	48K Spec.	Computer Ren.	Game	*
The Orb	48K Spec.	Computer Ren.	Adven.	*
The Castle	48K Spec.	Bug Byte	Adven.	*
The Devil Rides In	16K Spec.	Carnell	Arcade	*
The Forest	48K Spec.	Phipps	Sim.	*
The Great Western	16K Spec.	New Soft	Game	*
The Great Western	16K ZX-81	New Soft	Game	*
The Pyramid	48K Spec.	Fantasy	Arcade	7
The Turk	48K Spec.	OCP	Traditional	8
Time Bandits	16K Spec.	New Soft	Adven.	*
Time Bandits	16K ZX-81	New Soft	Adven.	*
Time Gate	48K Spec.	QS	Arcade	8
Tomb of Dracula	48K Spec.	Felix	Adven.	*
Tomb of Dracula	16K ZX-81	Felix	Adven.	*
Trace	16K Spec.	Zen	Utility	*
Trace	16K Spec.	Texgate	Utility	8
Train Game	16K Spec.	Microsphere	Game	9
Transylvanian Tower	48K Spec.	Shepherd	Adven.	*
Traxx	48K Spec.	QS	Arcade	7
Troon	48K Spec.	Hornby	Game	8
Tube Train Terror	48K Spec.	JRS	Game	*
3D Tunnel	48K Spec.	New Gen.	Arcade	9
Use and Learn	16K Spec.	Microl	Utility	8
Valhalla	48K Spec.	Movisoft	Adven.	*
Velnor's Lair	48K Spec.	QS	Adven.	8
Voice Chess	48K Spec.	Artic	Traditional	9
Volcanic Dungeon	16K ZX-81	Carnell	Adven.	*
Volcanic Dungeon	48K Spec.	Carnell	Adven.	6
Vu-Calc	16K Spec.	Sinclair	Business	7
Vu-File	16K Spec.	Sinclair	Business	8
Vu3D	48K Spec.	Sinclair	Utility	8
Warlord	48K Spec.	Lothlorian	Simulation	*
Wizard's Warriors	16K Spec.	Abersoft	Arcade	*
Word Fit	16K ZX-81	Ram Writer	Game	6
Word Processor	48K Spec.	Microl	Business	*
World Info	48K Spec.	Wimsoft	Utility	*
Wrath of Magra	48K Spec.	Carnell	Adven.	*
Xadom	48K Spec.	QS	Arcade	7
X Ray	16K Spec.	Zen	Utility	*
Yahtzi	48K Spec.	Work Force	Traditional	*
Yomp	16K Spec.	Virgin	Arcade	7
Zeus Assembler	48K Spec.	Sinclair	Utility	9
Zodiac I	16K ZX-81	Stellar	Utility	*
Zodiac II	16K ZX-81	Stellar	Utility	*
Zodiac F	48K Spec.	Stellar	Utility	7
Zuckman	16K ZX-81	DJL	Arcade	8
ZXAS	16K ZX-81	Bug Byte	Utility	*
ZX-Bug	16K ZX-81	Artic	Utility	*
ZX-Chess I	16K ZX-81	Artic	Traditional	*
ZX-Chess II	48K Spec.	Artic	Traditional	*
ZX 1K Chess	1K ZX-81	Artic	Traditional	*
ZX Compiler	16K ZX-81	Silversoft	Utility	*
ZXDB	16K ZX-81	Bug Byte	Utility	*
ZX Draughts	48K Spec.	CP	Traditional	*
ZXED	16K Spec.	dK' Tronics	Utility	*
ZX Forth	16K ZX-81	Artic	Language	8
ZX Forth	48K Spec.	Artic	Language	8
ZX-81 1K Games Pack	1K ZXZ-81	Crystal	Games	9
ZX Invasion Force	16K ZX-81	Artic	Arcade	*
ZX-81 Pocket Book	16K ZX-81	Phipps	Games	*
ZX-81 Remload	16K-64K ZX-81	Picturesque	Utility	*
ZX Screenkit	4K-64K ZX-81	Picturesque	Utility	*
ZX-sideprint	16K ZX-81	Microsphere	Utility	*

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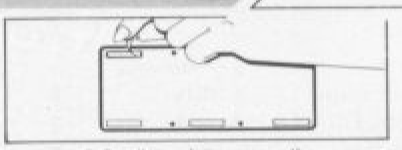




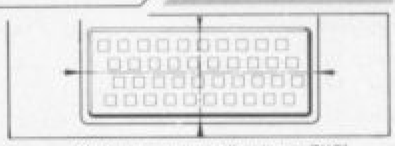
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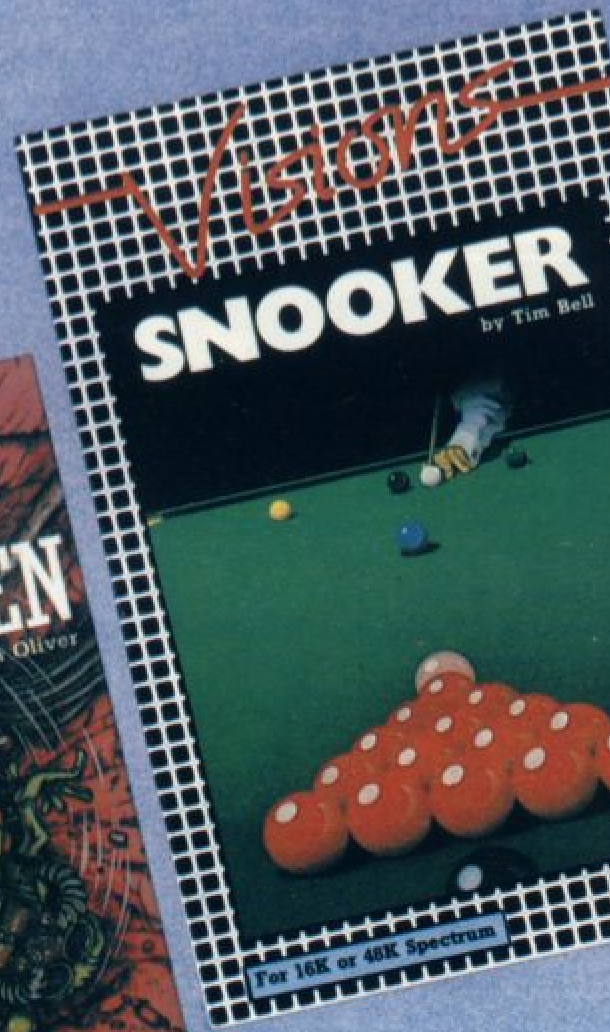
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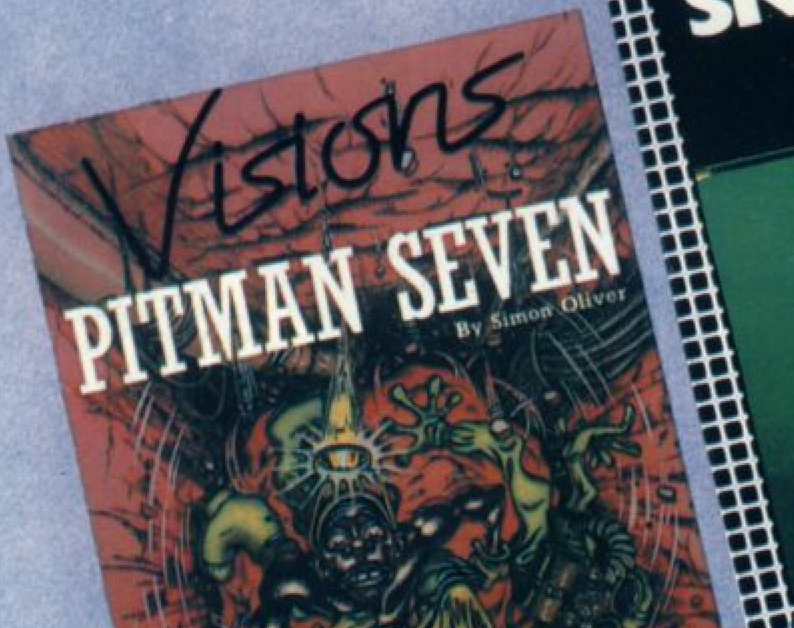
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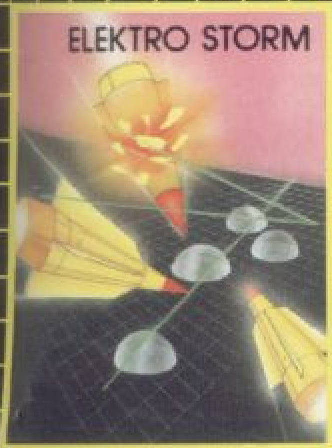
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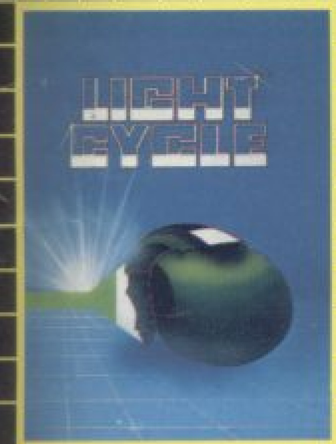
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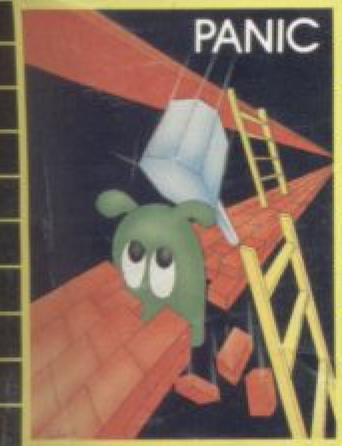
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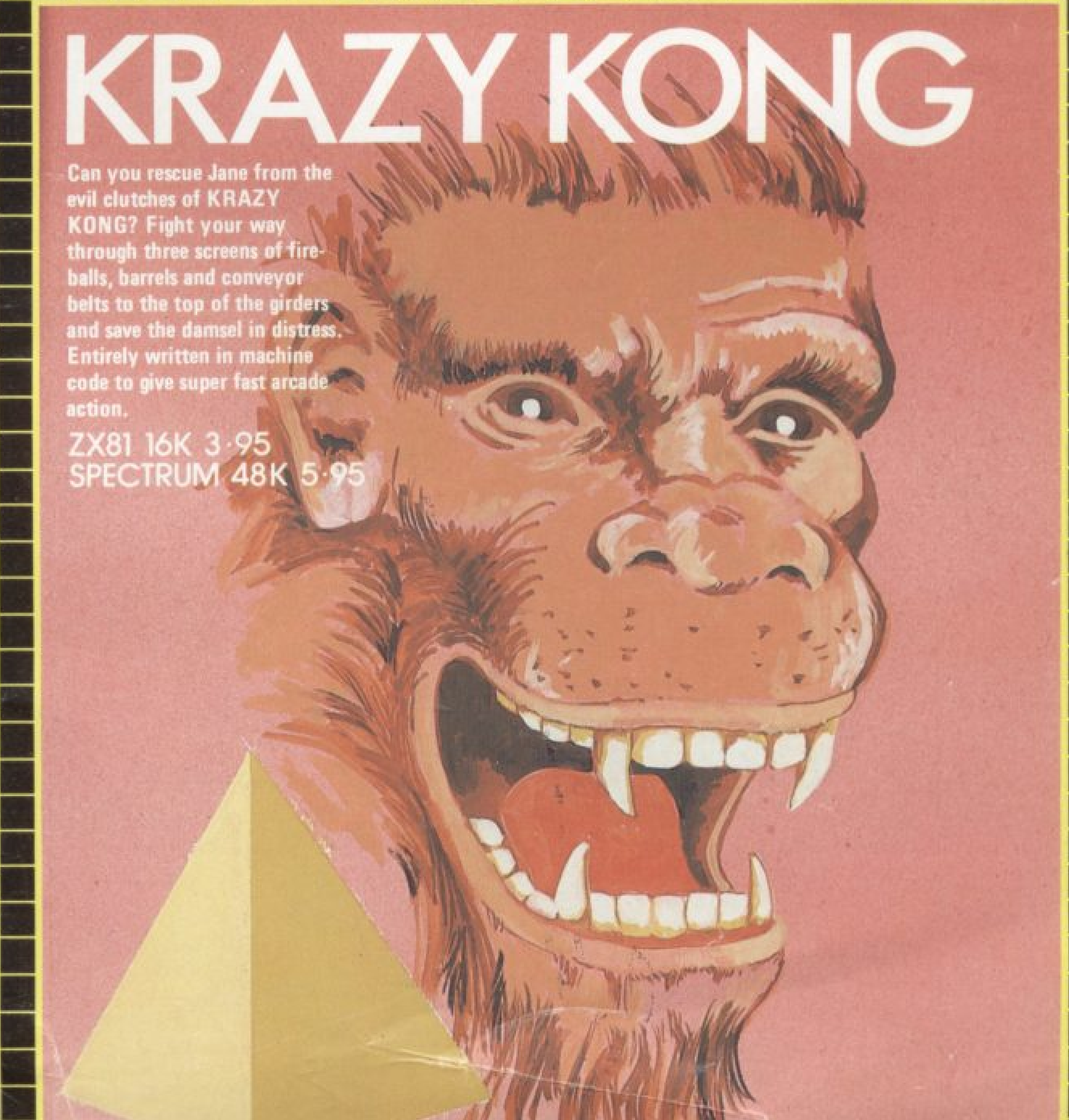
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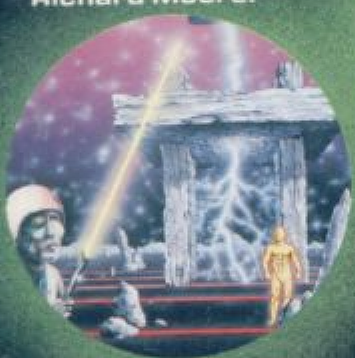
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